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STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

A PRELIMINARY HYDROGEOLOGIC INVESTIGATION IN THE NORTHERN PORTION OF DEAD CREEK AND VICINITY

by

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Introduction

Problem

The Illinois Environmental Protection Agency (IEPA) was made aware of a site in Cahokia, Illinois in May, 1980. There was a problem with periodic smoldering of materials in a ditch (Dead Creek) due to random dumping. Immediately, the problem did not appear to be serious, but when a local resident's dog rolled in the ditch and died of apparent chemical burns in August, 1980, it was clear that further investigation was need. IEPA personnel then did preliminary soil and water sampling to determine the conditions in the ditch. Upon finding that the soil in the ditch contained high levels of phosphorus, heavy metals, and PCB's, the Agency sealed the site off. This was done by the Illinois Department of Transportation (IDOT) and involved the installation of 7,000 feet of snow fence around the ditch and pond between Queeny Avenue and Judith Lane. It appeared to the Agency that soils and ground water were polluted in the area, and a detailed study was needed to assess the extent of pollution.

Purpose

The purpose of this study is to determine the hydrogeological framework at Dead Creek and to discuss possible disposal sites and their impact on ground water, surface water, soils, and plants in the area.

Method of Study

The study was primarily conducted by the Ground Water Management Section of the Division of Land/Noise Pollution Control, IEPA. Preliminary study involved the review of data in files, field work, and laboratory analysis. Adjacent land owners and businesses were contacted and permission was obtained for IEPA personnel and equipment to enter on their properties. Information was obtained from the Illinois State Geological Survey (ISGS) and the Illinois State Water Survey (ISWS) as to the general geology, and ground water conditions in the area. Local residents and officials were interviewed and a series of past aerial photographs were obtained to determine the site's history.

On September 8, 1980, the Agency's drill-rig sub-unit began to work at the site. This work included five hand auger borings, and the drilling of 12 test holes to determine the local geology and to install ground water monitoring wells. Soil samples were collected to analyze their physical and chemical properties. The ground water from the wells was sampled for quality and the potentiometric levels were recorded from time to time.

All inorganic soil and water analyses from the site was done by the IEPA Champaign Laboratory using the Inductively Coupled Argon Plasma (ICAP) emission spectrometric method. Organic soil and water analyses were done at the IEPA Springfield Laboratory using gas chromotography/mass spectometry methods. Grain size and permeability analyses for the soils, were also performed by the IEPA Champaign Laboratory according to ASTM standards.

Other Studies

At the request of U.S.EPA, Region V, the Environmental Monitoring Systems Laboratory conducted a thermal infrared survey of the subject site and its vicinity (Becker, 1981). Multispectral Scanner Data and color infrared photographs were obtained in December, 1980 and analyzed. Five active waste disposal areas and two probable, revegetated burial sites were identified from the color infrared photography (Figure 1a). Furthermore, four outfalls were detected entering the holding ponds on Cerro Copper Company's property. These were detected from the Multispectral Scanner Data.

Acknowledgements

Thanks are extended to the Emergency Action Center of the IEPA, ISGS, ISWS, IDOT, U. S. Army Corps of Engineers (USACE), U. S. Department of Agriculture (USDA), Cerro Copper Company, Mr. Reed Neuman of the Attorney General's Office, and Honer and Shifrin, Inc. for materials, assistance, and services. A special thanks is extended to Dr. Paul Hiegold of the ISGS for his assistance on field studies. The majority of field data was collected by Doug Tolan and Ken Bosie.

Site Description

Location

Dead Creek is located in the towns of Sauget and Cahokia in St. Clair County, Illinois (see Figure 1). The creek supplies drainage for part of the Mississippi River flood plain known as the American Bottoms. It starts in the town of Sauget and flows southwest through Cahokia until it discharges into the Prairie DuPont Floodway. The Floodway in turn discharges to the Cahokia Chute of the Mississippi River.

As might be expected of a flood plain, the area is typified by very little relief, and is protected against flooding by a system of levees that front the river.

The area covered by this report is outline in the square on Figure 1. Although some of the data was collected outside, the study area is the part of Dead Creek bounded by Queeny Avenue and Judith Lane.

Climate

The site is located in the northern temperate zone which is characterized by warm summers and moderately cold winters. The average annual precipitation in the area is about 38 inches (ISWS, 1965). Figure 2a shows the mean monthly averages taken at Edwardsville. The greatest amounts of rainfall occur from March through June, then a gradual monthly decline occurs until December. With the average calculated evapotranspiration given to be about 33 inches (Figure 2b), the average potential water surplus is then about 5 inches for the area in a year. Some of this surplus water will infiltrate the soil and move downward.

Site Development

Subsequent to reviewing data in files and interviewing several persons, it was concluded that a pollution problem might exist outside the realm of mere dumping into the creek itself. Local residents reported a wide variety of past waste disposal activities in the area. All had two main themes: 1) that gravel pits had existed in the past on the east side of the creek near Sauget Town Hall and 2) that some sort of waste had been buried in the pits prior to their filling.

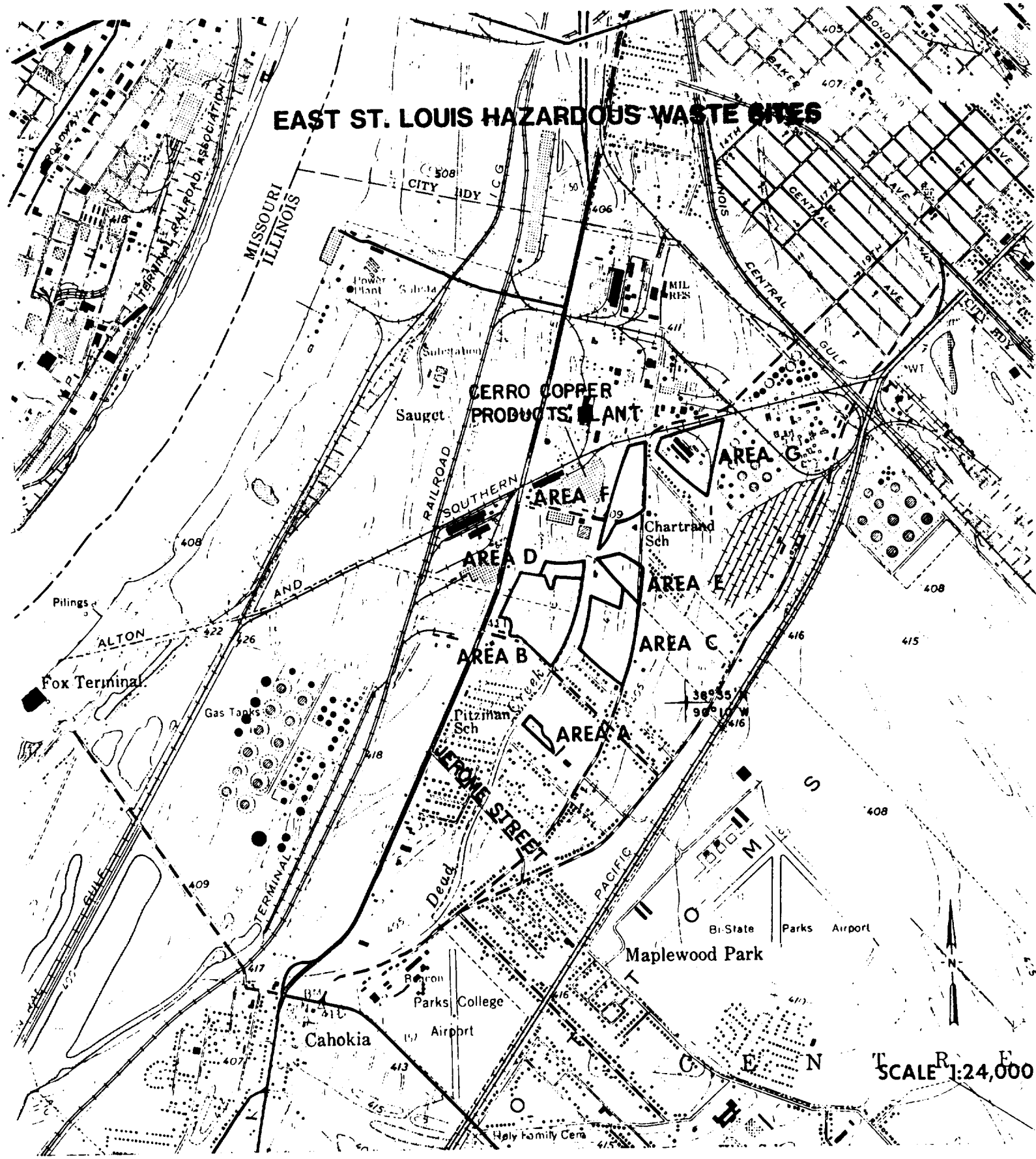


Figure 1a. Waste sites identified by the thermal infrared survey.

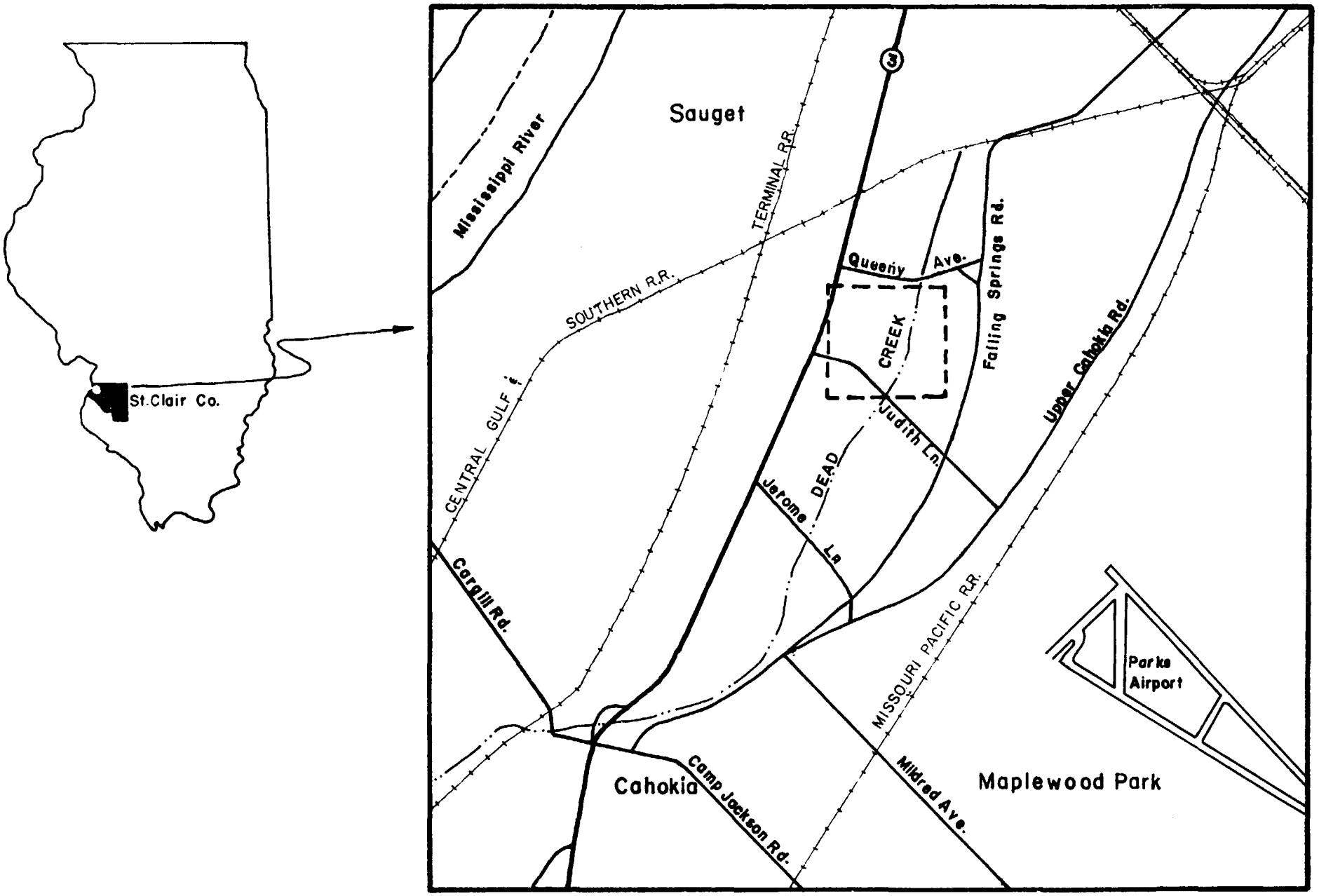
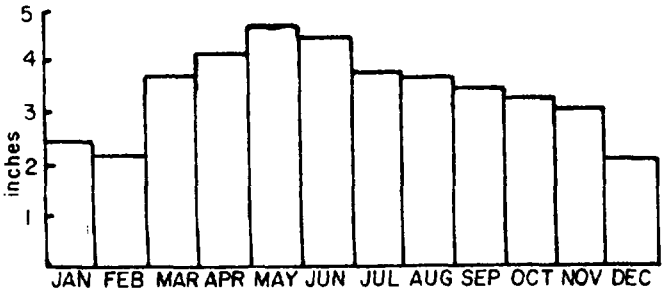
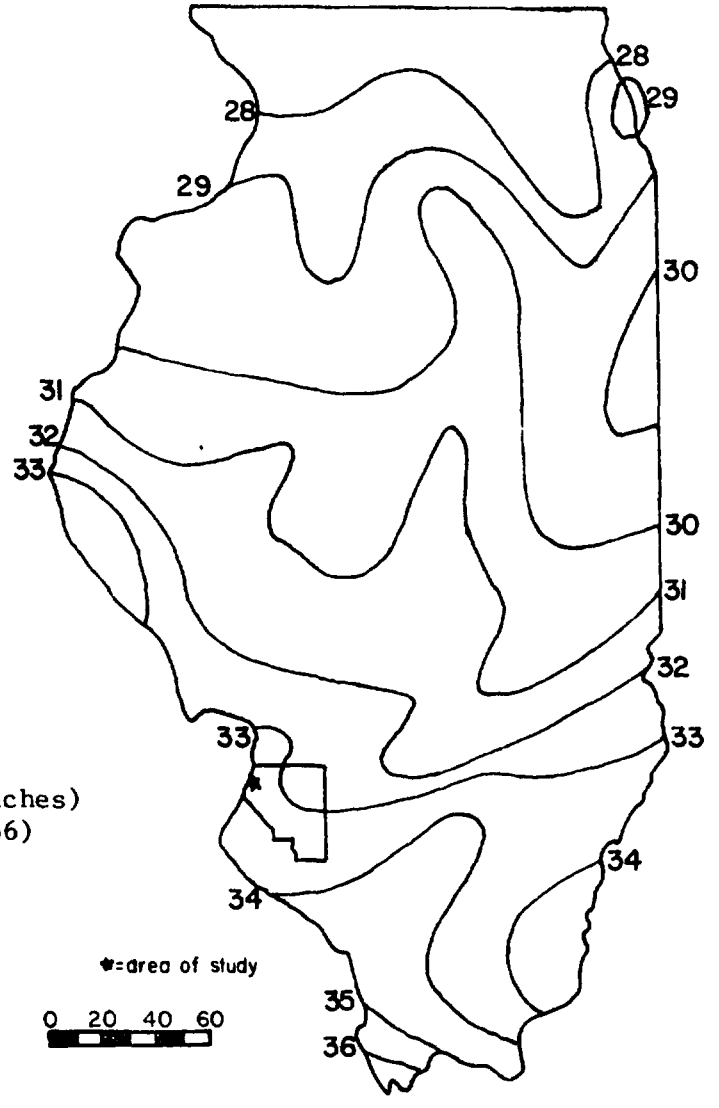


Figure 1. Location of Dead Creek and study site (square)



(a) Mean monthly precipitation at Edwardsville, Illinois (1932-1962)



(b) Mean annual calculated evapotranspiration (in inches) over 45 years (Jones, 1966)

Figure 2. Climatological data

To confirm the information on these past events, a series of aerial photographs for stereo viewing was ordered for the years 1937, 1940, 1950, 1955, and 1962. From the analyses of aerial photographs and review of the file data, the following potential disposal sites were identified: an open dump, part of which was a sand pit, a holding pond at Cerro Copper, a disposal impoundment, a pond by H. H. Hall Construction Company (a former sand pit), and 3 sand pits which are now filled. Two probable disposal areas on each side of Dead Creek, identified by Becker (1981) were not supported by the aerial photographs.

1937

Figure 3a is a drawing made from aerial photographs of the area in 1937. The Figure shows a large sand pit (A) on the east side of Dead Creek with an access road leading up to Old Queeny Avenue.

1940

Figure 3b is a drawing which represents the area in 1940. The sand pit (A) has been enlarged towards the east and the access road now leads to Falling Springs Road.

1950

The next photographs were taken in 1950, a drawing of these photos is shown on Figure 3c. It is evident from the photgraphs that a great deal of change took place in ten years. The former large pit (A) has now been bisected by a berm with New Queeny Avenue built on top of it. The pit was partially filled in the eastern half, south of New Queeny Avenue, and enlarged a great deal to the north. Aside from this, four new pits were excavated. Two are north (B) and south (C) of Old Queeny Avenue along Dead Creek. One (D) is on the west side of the creek just south of New Queeny Avenue. The last is a large pit (E) dug by H. H. Hall Construction Company near Judith Lane whose access road probably became Walnut Street. In this photograph the south branch of Old Queeny Avenue has been subtended and Sauget Town Hall is under construction where the street once was.

This verifies the statements by local residents that sand pits were once located around Sauget Town Hall.

1955

The drawing (Figure 3d) from photographs taken during 1955 again show a drastic change. Sauget Town Hall is completed and is surrounded by low lying areas. These low lying areas are the result of fill materials settling in the former sand pits. At this time, the pit (B) on the east side of the creek across from Cerro Copper has yet to be completely filled. The pit (E) by Judith Lane is still unchanged.

1962

By 1962 (Figure 3e), the drawing shows that the pits once surrounding Sauget Town Hall have been filled. Settlement has developed prominent troughs in areas that were previously excavations. The only remaining pit is still the one south by Judith Lane (E).

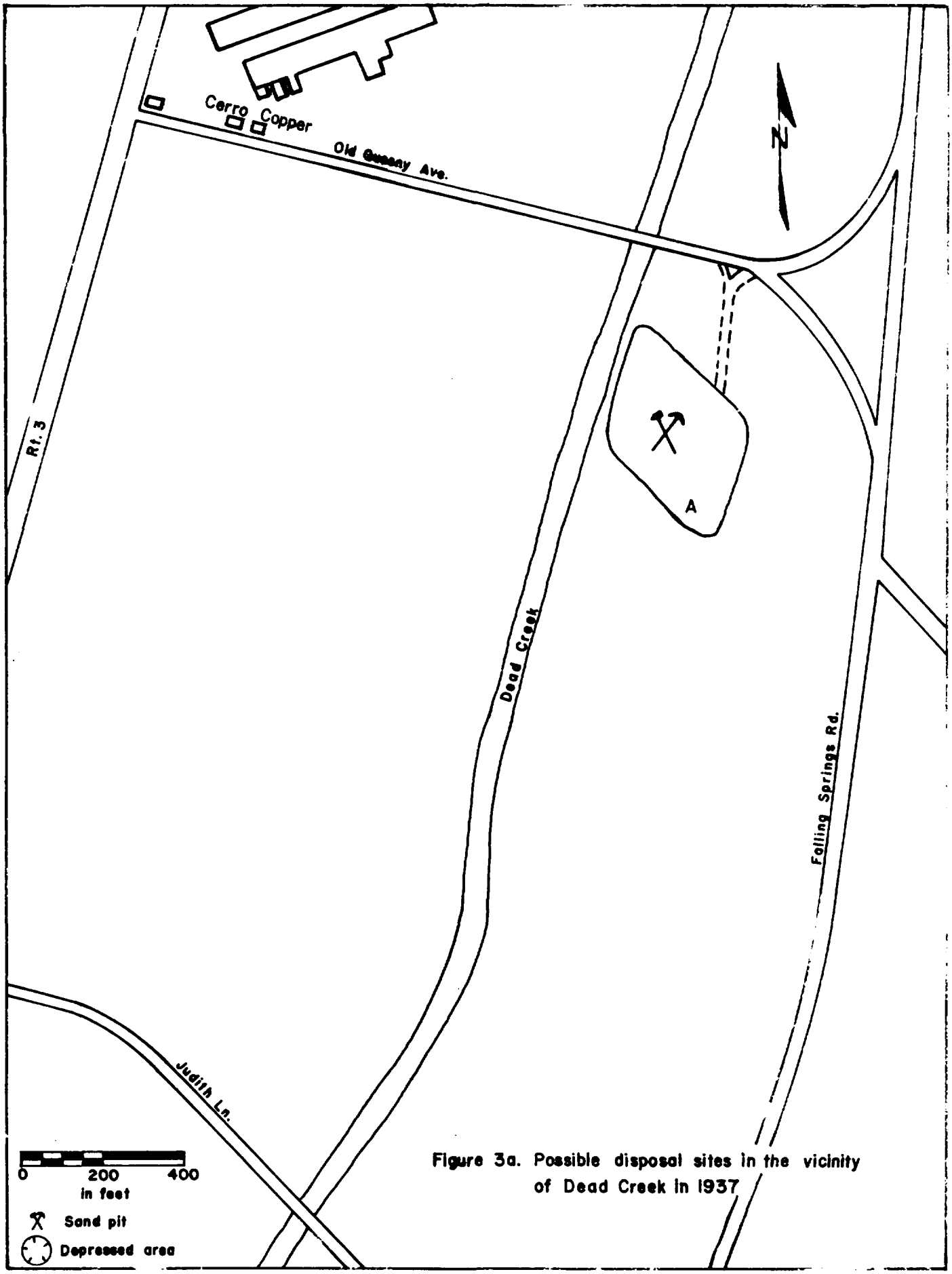


Figure 3a. Possible disposal sites in the vicinity of Dead Creek in 1937

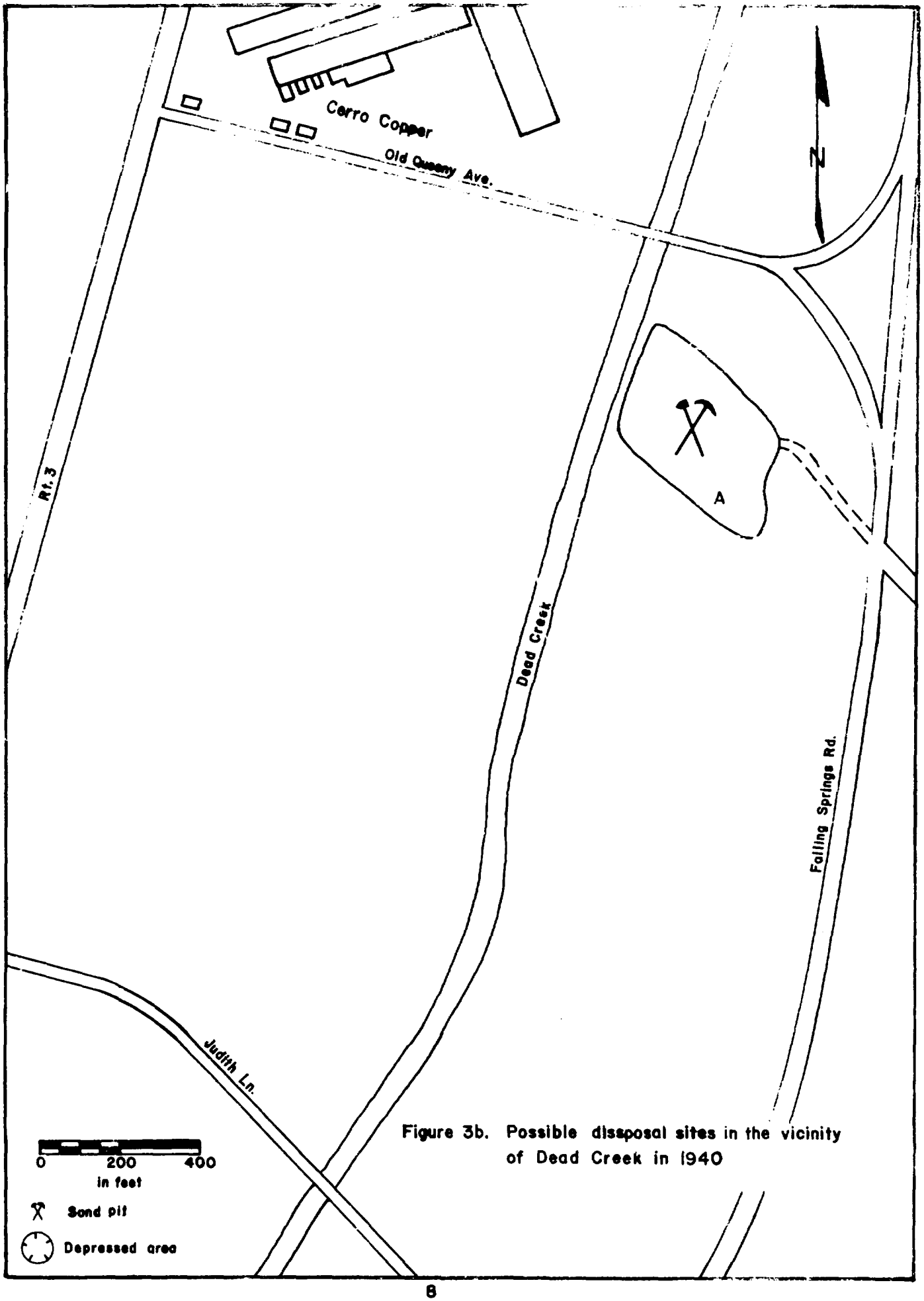


Figure 3b. Possible dissposal sites in the vicinity of Dead Creek in 1940

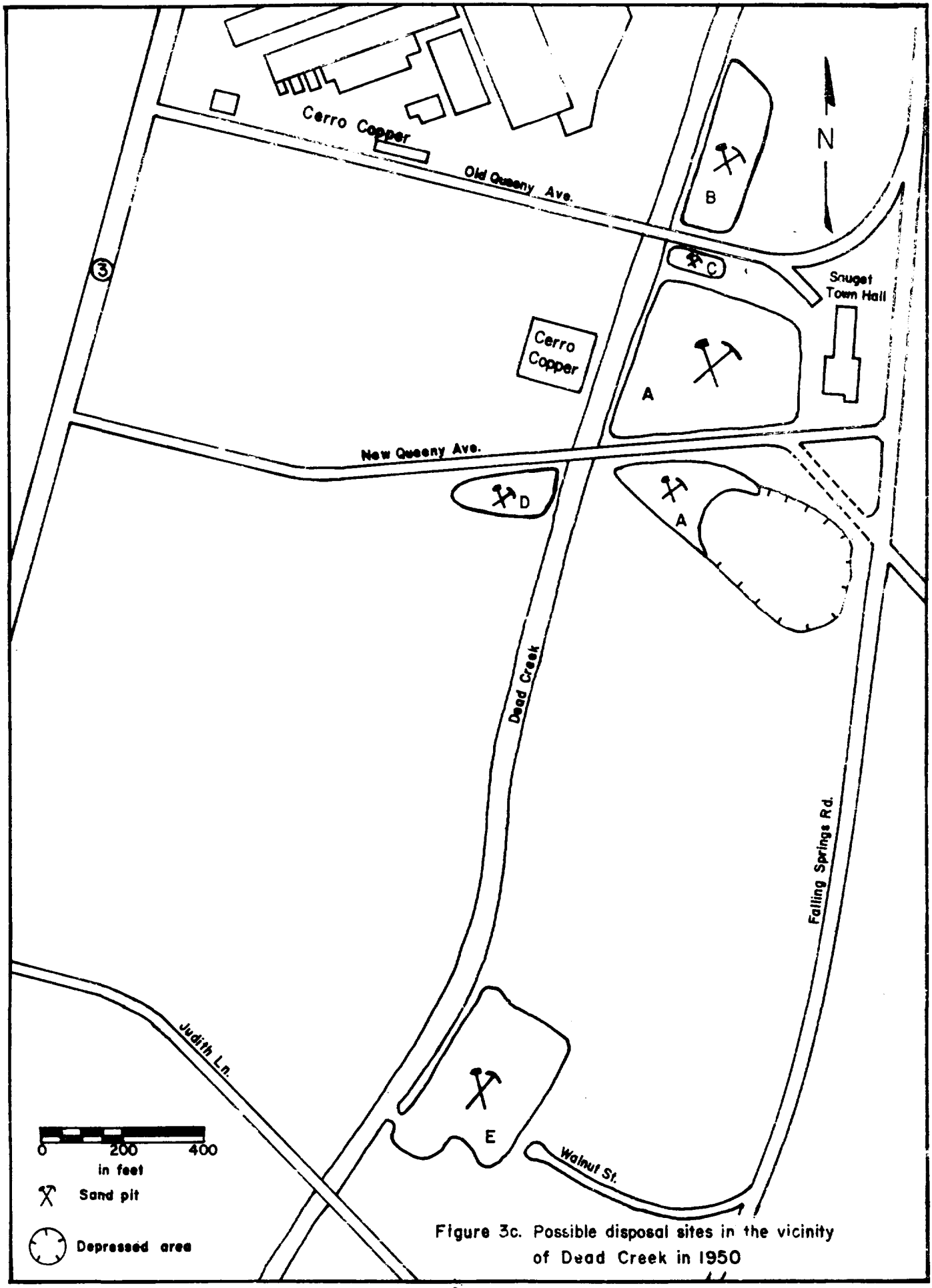


Figure 3c. Possible disposal sites in the vicinity of Dead Creek in 1950

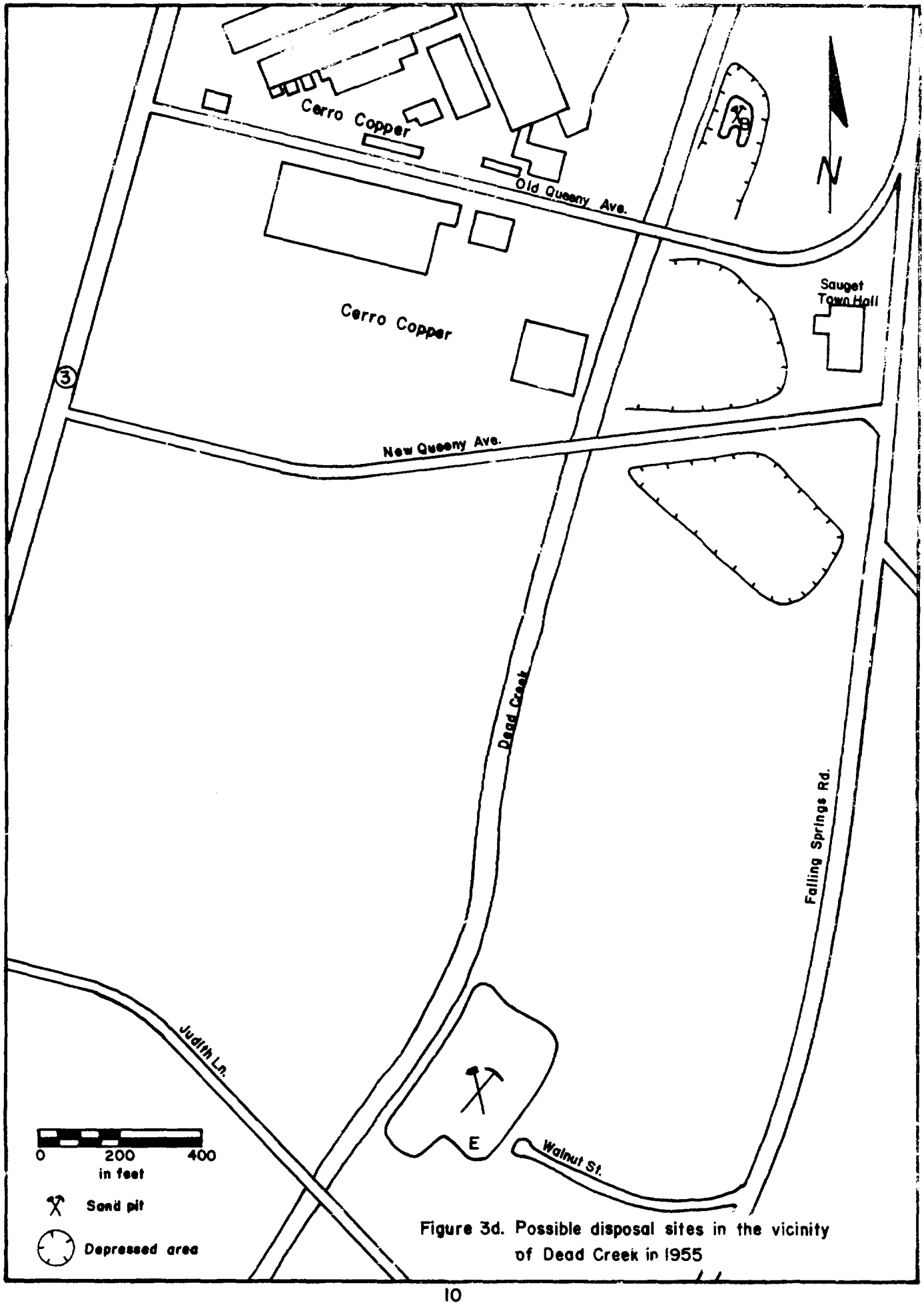


Figure 3d. Possible disposal sites in the vicinity of Dead Creek in 1955

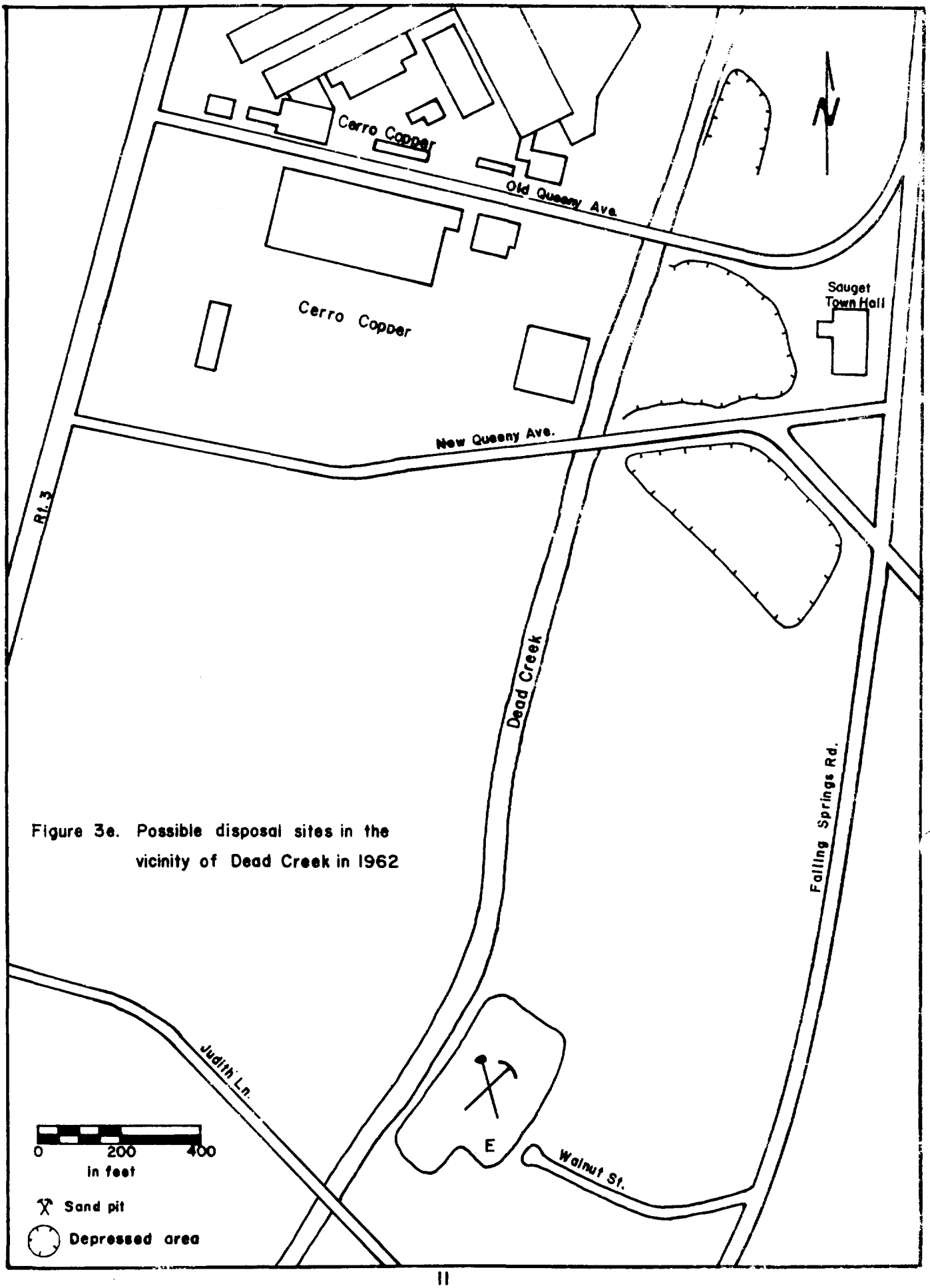


Figure 3e. Possible disposal sites in the vicinity of Dead Creek in 1962

1973

Figure 3f was drawn from a map of the East St. Louis area developed by the USACE. It shows the location of Harold Waggoner and Company, a trucking firm which specialized in hauling industrial wastes.

Mr. Waggoner operated the company from 1964 to 1974 when he sold out to Ruan Trucking Company. Prior to August 6, 1971, Mr. Waggoner made a practice of washing his waste hauling trucks out and discharging the contents into Dead Creek (IEPA files). At this time, he was ordered by the IEPA to stop such practices and inform the Agency of his plans for future operation. This is when the disposal impoundment pictured in Figure 3f was put into use. Disposal into this impoundment only served to turn surface water pollution into ground water pollution. Ruan Trucking Company is said to have continued this practice until 1978 when they leased the property to Metro Construction Company who subsequently covered it up. (Personal communication, Attorney General's Office).

Other possible sources of pollution at the creek

At the time of writing, the only other known source of discharge into the creek was that by Midwest Rubber Company. From the late 1940's to the early 1960's they had a pipeline leading from their factory on Illinois Route 3 to the creek. It discharged wastes from their manufacturing process, which included rubber, into the creek. These wastes most likely account for the "bed spring" effect when one walks in the creek bottom.

Field Work

Aerial photographs of the site would not arrive until the drilling phase of the investigation was completed. It was felt, then, that geophysical methods might be employed to determine the location, size, and depth of the pits, and whether they contained drums. It was obvious while at the site that portions of it had slightly subsided. These sunken areas were felt to be where former pits could have been (later proven correct by the aerial photos). If drums had been buried in them it was reasonable that a metal detector survey might determine these locations. This proved to be fruitless as the fill, and the area in general, consisted mostly of demolition wastes containing large amounts of metal. Since electrical resistivity is affected by metal, it was rendered useless as well. A seismic survey run by the ISGS was the only other means of obtaining information about the pits. Unfortunately, the data from the seismic profile was inconclusive due to interference (noise) by local industry and traffic. Thus, none of the geophysical methods employed was useful. Specifications of geophysical instruments are in Appendix 3.

Following the geophysical investigation, five had auger borings and 12 test holes were drilled. The 12 test holes were later implaced with ground water monitoring wells. The location of these monitoring wells, along with the hand auger borings, and local topography are shown on Figure 4.

Appendix 1 is boring log and monitor well information and Appendix 2 contains selected grain size distribution and permeability data from these borings. The class limits scale used was a modified Wentworth-Lane (Pettijohn, 1975) and the textural terminology was that used in Figure A-1. The monitor well depth ranged from 28 to 40 feet and all were finished in the Henry Formation Sands. They were slotted from at least five feet above the water table to the base. None of the holes reached bedrock. The hand auger borings in the creek bottom

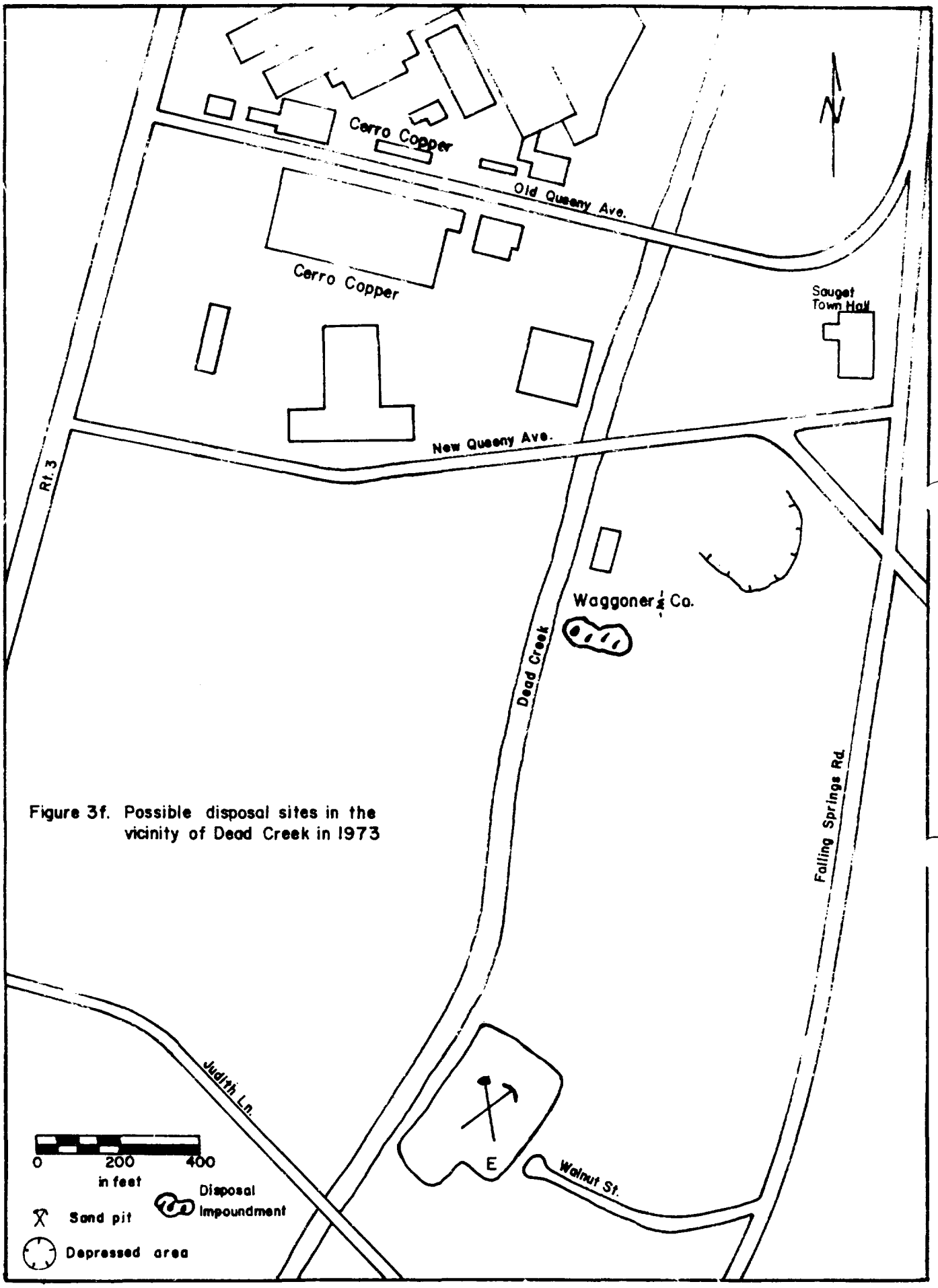


Figure 3f. Possible disposal sites in the vicinity of Dead Creek in 1973

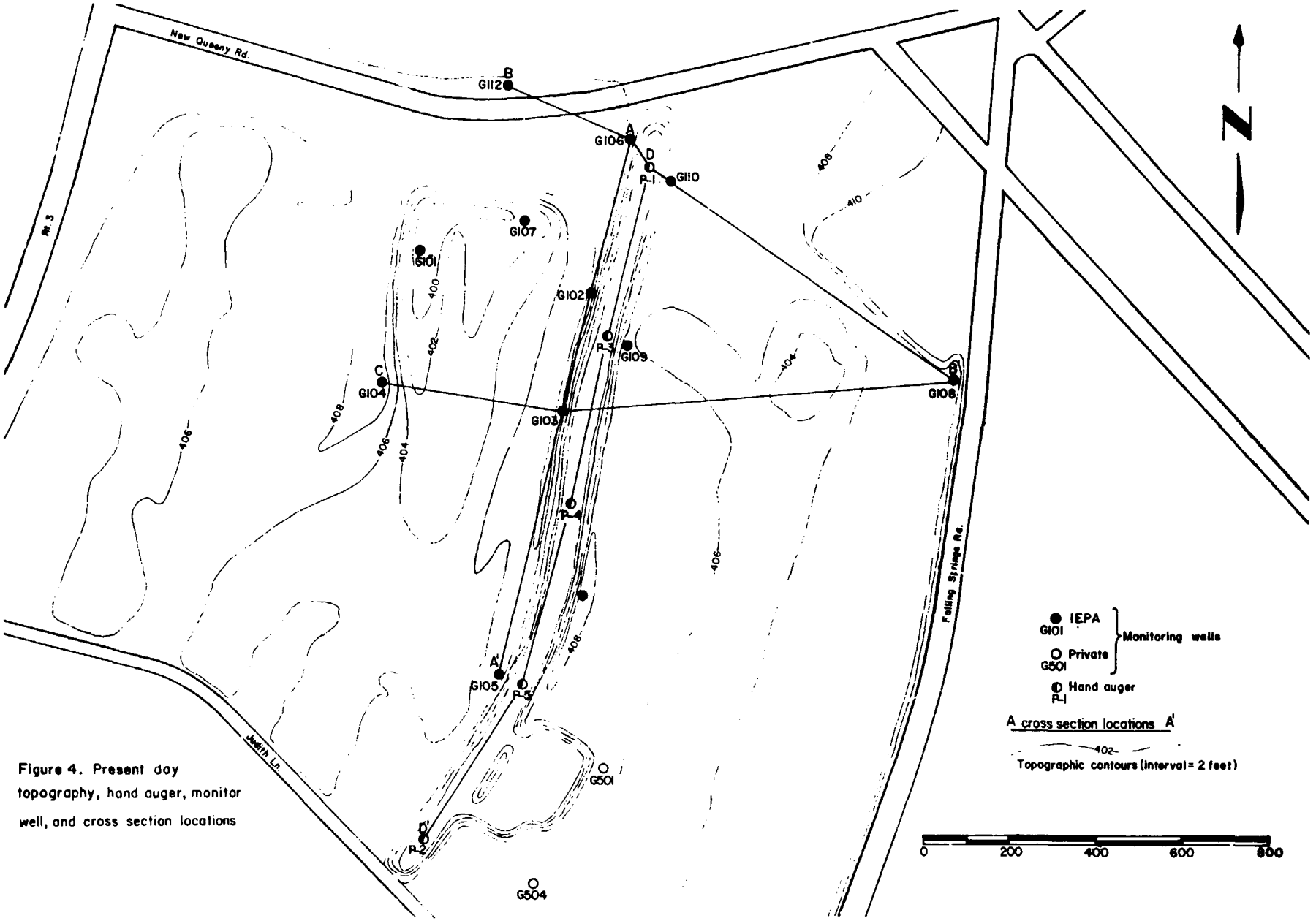


Figure 4. Present day topography, hand auger, monitor well, and cross section locations

were made to determine the thickness of the fill material. They ranged from 8 to 10 feet in depth and were finished upon reaching the Henry Formation Sands.

Geology

Dead Creek is situated in the Mississippi River flood plain on thick valley deposits (100'+). The valley fill is comprised of two formations, one of which is a thin mantle called the Cahokia Alluvium. Derived from the erosion of till and loess, the alluvium consists of unconsolidated, poorly sorted, silt, with some local sand and clay lenses. It appears to have accumulated in valleys during flood intervals after the Wisconsinan glaciers had retreated.

The Cahokia Alluvium formation unconformably overlies the Mackinaw Member of the Henry Formation. The Henry Formation is Wisconsinan glacial outwash in the form of valley train deposits. It accounts for the majority of the valley fill and is composed of sand and gravel that coarsens with depth. Due to the thickness and water capacity of this formation, it is a major aquifer for the East St. Louis area.

Mississippian limestone underlies the valley fill deposits at a depth of approximately 120 feet (Bergstrom, 1956).

Site Geology

Based on the 12 test holes, 5 hand auger borings, and the ISGS publications, a generalized rock stratigraphic column for shallow depths is shown in Figure 5. Cross sections (Figures 6a and 6b) show that geology at this site corresponds to the general description of the area previously given. The location of these cross sections appear on Figure 4.

Data from the 12 test holes indicates that the Henry Formation sand, which extends to bedrock, is overlain by the Cahokia Alluvium. The thickness of the alluvium is between 6 and 17 feet in the test holes and becomes thinner toward the east. The alluvium is primarily composed of silt with local clay and sand lenses, and also shows a tendency to be sandy at the base.

The Henry Formation is a major aquifer for the area and the portions sampled by the IEPA showed it to be an arkosic, gray, fine to medium grained sand. Forme~ sand pits in the area were excavated to attain these sands.

Permeability values measured in the laboratory (Appendix 2), are in the order of 7×10^{-6} cm/sec and 4.4×10^{-3} cm/sec for the Cahokia Alluvium and Henry sands, respectively. Vertical distribution of permeability values are in Figure 6a.

Hand auger borings P-1 through P-5 were made in the creek bottom and they show that the material there is a fill composed of loosely compacted silty clay to clayey silt (Figure 6b). Because the velocity of creek flow was great enough to erode vertically at one time, a scouring in the creek through the upper silt mantle into the sand occurred. At a later date the energy of the stream decreased and the clayey silt now seen in the bottom of the creek was filled down into the Henry Formation sands. This deposit, since it is less consolidated than the older materials bounding it, is felt to have a permeability in the range of 1.0×10^{-6} cm/sec.

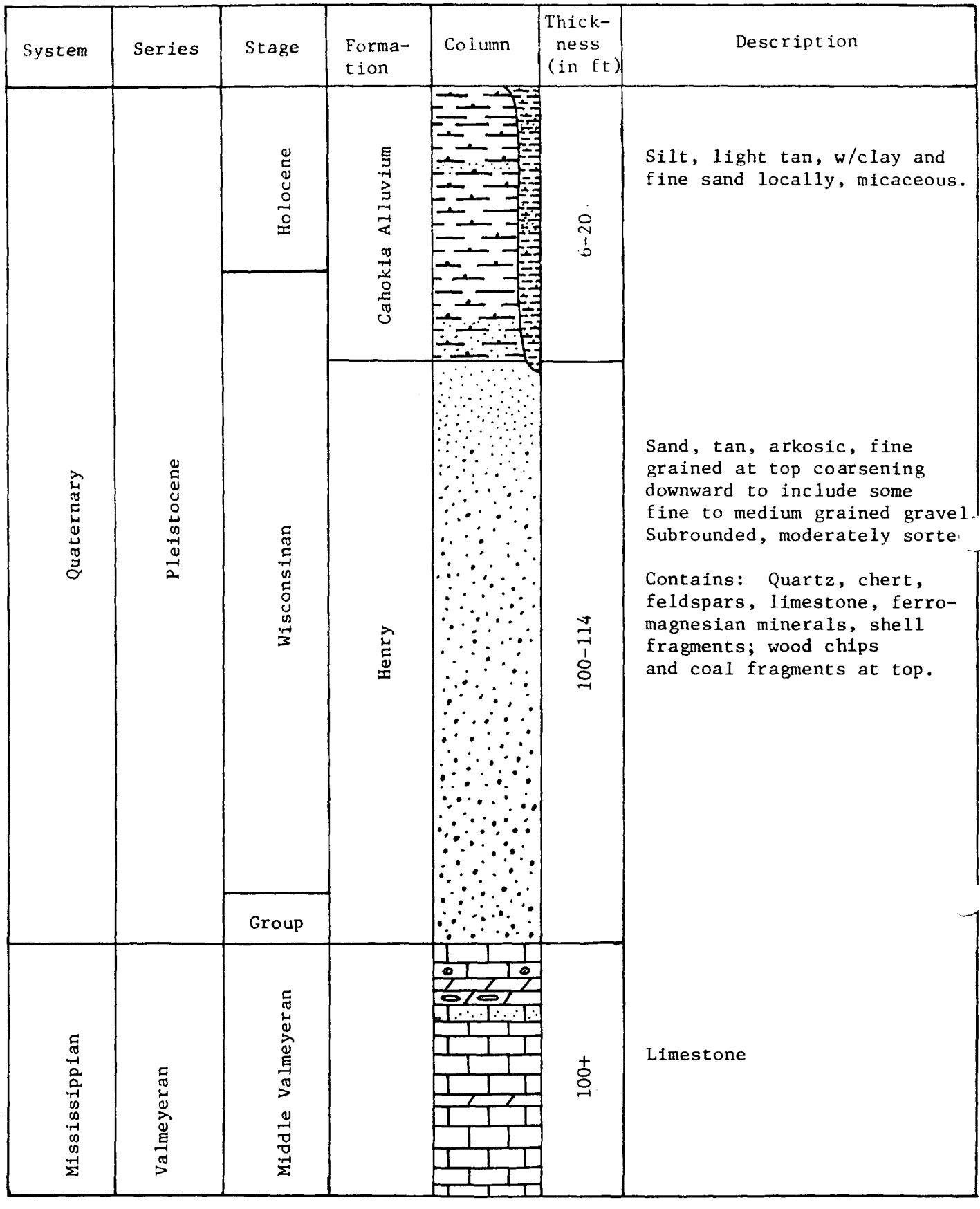


Figure 5. Generalized Geologic Column for unconsolidated deposits to bedrock in the Dead Creek area.

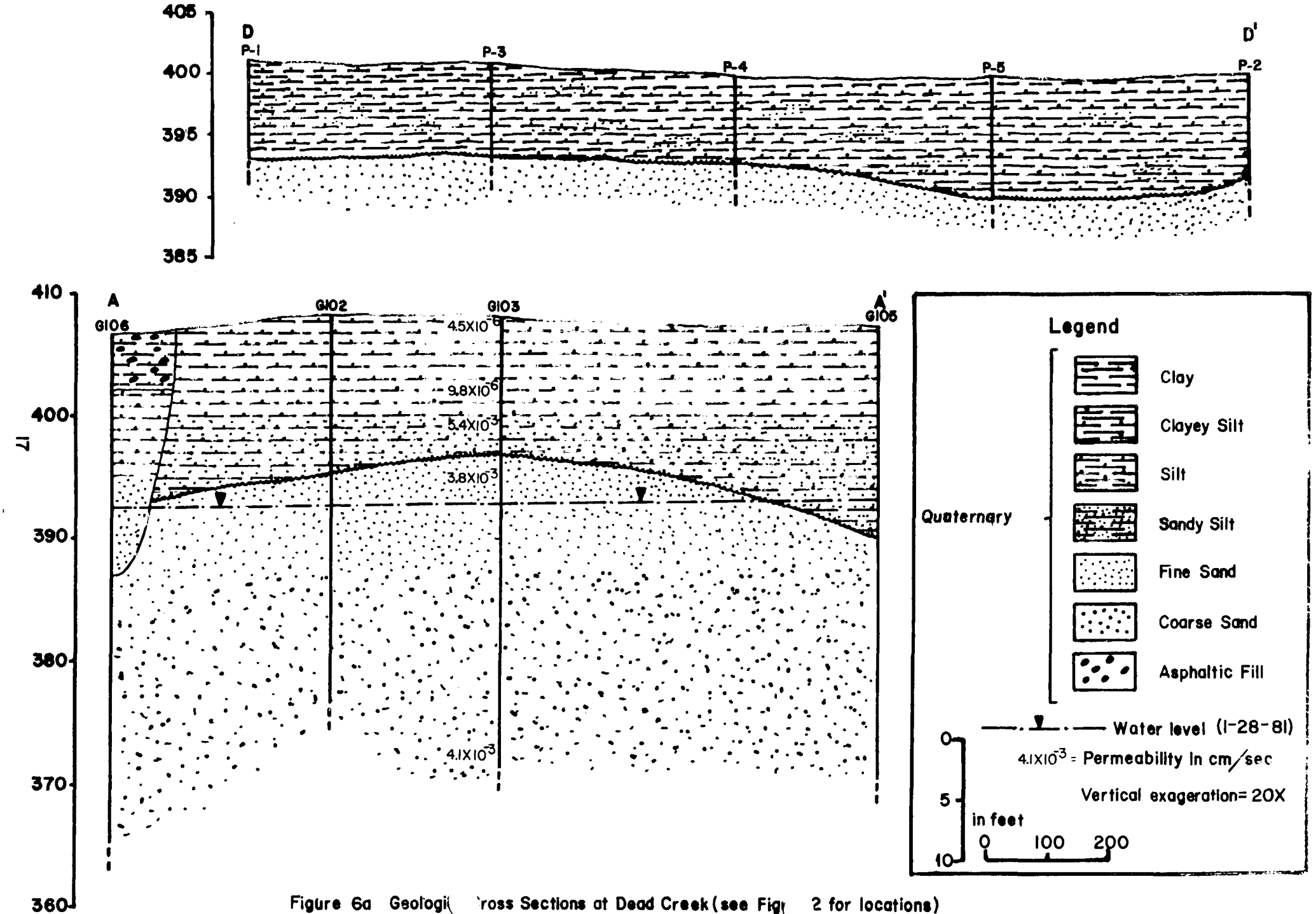


Figure 6a Geologi(ross Sections at Dead Creek (see Fig(2 for locations)

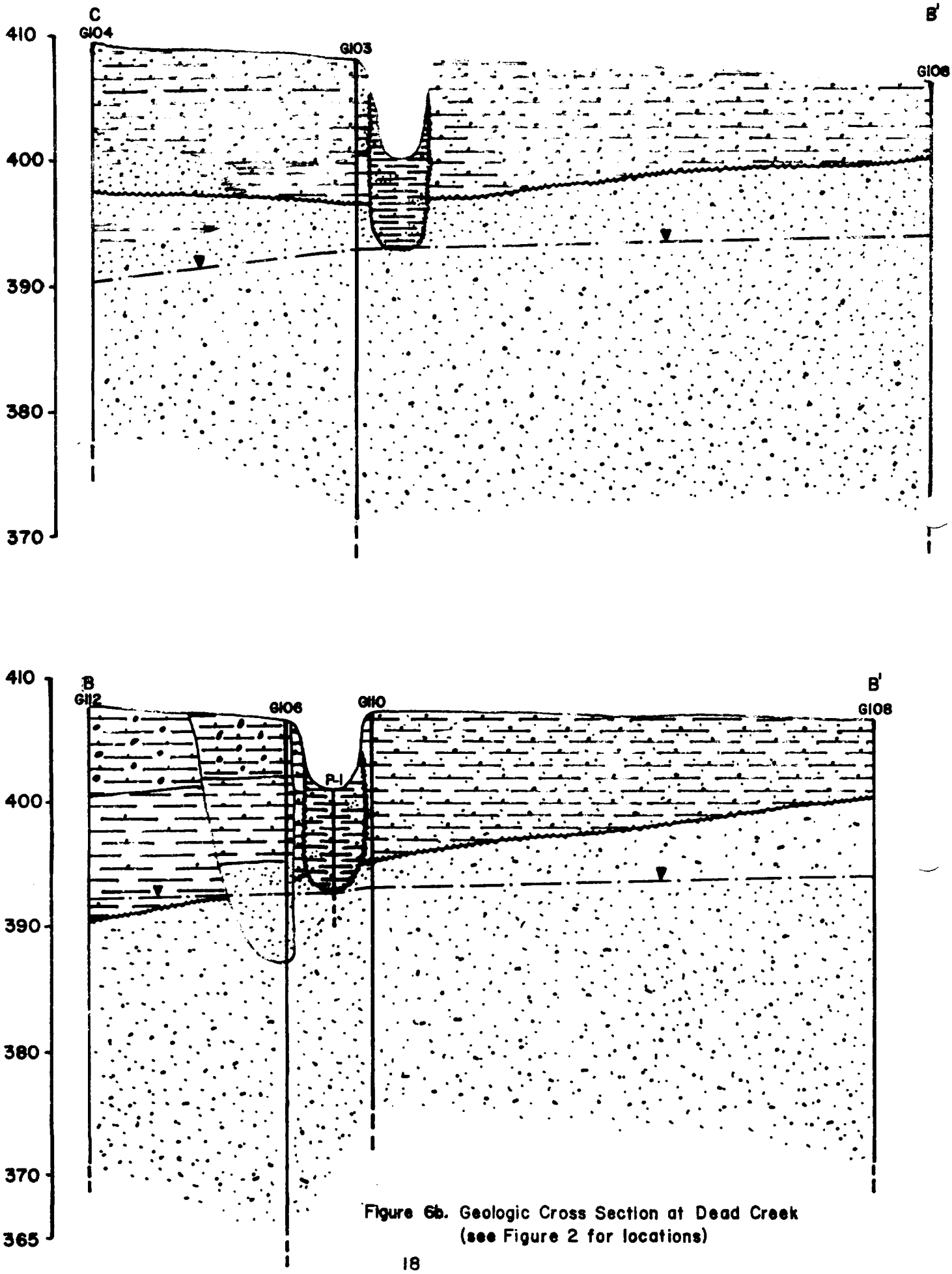


Figure 6b. Geologic Cross Section at Dead Creek (see Figure 2 for locations)

Chemical Analyses of Soil

The soils adjacent to and in Dead Creek were sampled extensively to assess the impact of disposal practices. Results were evaluated to determine horizontal and vertical distribution of contaminants. The location of these samples is given in Figure 8 and analyses appear on Table 1. A general description of the soil analyses for Dead Creek is: 1) high concentrations of organics in the north end of the creek by New Queeny Avenue, 2) high concentrations of inorganics in the south away from New Queeny Avenue, and 3) slight vertical migration of inorganics and PCB from the surficial soils into the underlying sand deposits.

Surficial soils

Chemical analyses from surficial soil samples are listed in Table 1. In addition, the analyses of soil samples in monitoring wells G106, G107, and hand auger boring P-1 are discussed and presented in Figures 7a, 7b, and 7c. Over all, 31 soil samples were analyzed in the area, and sampling locations are shown in Figures 2 and 8.

Outside the boundaries of the creek bed itself five surficial soil samples, X119, X120, X121, G106, and G107, were taken and analyzed in an attempt to locate outside dumping sources. Analyses of these samples show relatively low concentrations of chemicals with the exception of PCB, which is .62 ppm, 1.1 ppm and 80 ppm at G107, X119, and X120 respectively. These samples lie in areas where past dumping of wastes is suspected.

The analysis of X121 had the lowest concentrations of chemicals when compared to all the other soil samples in the study. In fact, it showed the lowest concentrations of barium, cadmium, chromate, copper, lead, nickel, silver, sodium, strontium, and vanadium. Therefore, this sample is considered to be representative of background quality for soil in the area.

Surficial soil sampling outside the area of Dead Creek also took place in the holding ponds behind Cerro Copper's recycling plant. These ponds at one time were the head waters to Dead Creek. When flow was restricted under New Queeny Avenue, the creek was graded to the north so water would drain to a catch basin installed by Monsanto. The water entering this catch basin is then pumped to the Cahokia sewage treatment plant. Full restriction of flow under New Queeny Avenue is somewhat suspect as IEPA personnel have observed water flowing from the plug downstream in the creek. Since there is a storm sewer in the culvert it could account for this flow, but the possibility of the holding ponds backing up to cause flow must also be taken into consideration. Whatever the case might be, it is obvious that these holding ponds are highly polluted. Sediment samples X128 and X129 (Table 1) taken in them show PCB, aliphatic hydrocarbons, dichlorobenzene, silver and high concentrations of nickel, lead, cadmium, arsenic, copper, and manganese. In addition, the highest chromate concentration of 491 ppm was found in X129.

Sometime after 1950 the culvert at Judith Lane was blocked, but after reaching an undetermined level, it does flow. Water then moves downstream as shown in Figure 8 to the Prairie DuPont Floodway. IEPA personnel have sampled the soils from the creek along its path to the Floodway and the analyses appear in Table 1. When downstream soil samples X101, X102, X103, X104, and X105 are compared to the background soil sample X121 (Table 1) it is seen that they contain relatively high concentrations of aluminum, barium, boron, cadmium, chromate, copper, lead,

Table 1. Chemical analysis of soils (in ppm, dry weight material)

Parameters	Sample number						
	X101	X102	X103	X104	X105	X106	X107
Aluminum	12,000	NA	NA	NA	NA	NA	NA
Arsenic	26.0	NA	NA	NA	NA	NA	6,000
Barium	1,300	4,700	210	390	475	NA	4,800
Berylium	<4.0	3.0	<0.5	2.0	<1.0	NA	< 1.0
Boron	<10.0	76.0	< 10.0	<10.0	<10.0	NA	NA
Cadmium	<40.0	50.0	8.0	31.0	2.0	NA	70.0
Calcium	24,000	5,300	210,000	16,000	13,000	NA	11,000
Chromium	400	50.0	60.0	50.0	< 50.0	NA	360
Cobalt	40.0	32.0	6.0	8.0	9.0	NA	30.0
Copper	15,000	17,200	320	1,800	360	NA	32,000
Iron	57,000	110,000	11,000	19,000	18,000	NA	70,000
Lead	800	1,300	260	250	75.0	NA	2,400
Magnesium	7,100	2,000	10,000	5,100	3,300	NA	2,900
Manganese	600	170	210	160	200	NA	150
Mercury	1.2	NA	NA	NA	NA	NA	NA
Nickel	2,000	2,300	45.0	600	< 50.0	NA	3,500
Phosphorus	NA	6,200	720	1,200	4,200	NA	7,040
Potassium	2,400	900	1,400	2,100	1,400	NA	1,200
Silver	< 100	45.0	10.0	< 10.0	< 10.0	NA	40.0
Sodium	800	1,100	100	190	125	NA	1,700
Strontium	100	140	210	47.0	43.0	NA	180
Vanadium	<80.0	50.0	22.0	31.0	35.0	NA	60.0
Zinc	12,000	21,000	900	5,600	780	NA	25,000
PCB	.120	.120	2.8	2.0	< .050	5,200	120
Aliphatic hydrocarbons	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Alkylbenzenes	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chloronitrobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dichlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Hydrocarbons	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Naphthalenes	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Table 1. Chemical analysis of soils (in ppm, dry weight material) (cont)

Parameters	Sample number						
	X108	X109	X110	X111	X112	X113	X114
Aluminum	8,000	9,100	7,000	8,000	6,600	10,000	6,400
Arsenic	44.0	25.0	67.0	80.0	50.0	300	23.0
Barium	3,800	1,600	4,300	1,800	8,000	2,400	1,600
Berylium	<4.0	<4.0	<4.0	<5.0	<5.0	<5.0	<3.0
Boron	<10.0	<10.0	<10.0	<15.0	<15.0	NA	<7.0
Cadmium	<30.0	200	40.0	100	100	400	<10.0
Calcium	10,000	24,000	16,000	13,000	30,000	11,000	14,000
Chromium	300	<40.0	140	50.0	50.0	250	400
Cobalt	30.0	20.0	<20.0	<30.0	30.0	100	<20.0
Copper	31,000	7,700	22,000	15,000	41,000	3,800	4,800
Iron	58,000	75,000	67,000	68,000	52,000	365,000	55,000
Lead	2,000	1,700	2,000	2,000	5,100	3,600	2,000
Magnesium	3,900	3,600	4,100	4,000	4,000	4,000	2,800
Manganese	150	300	200	160	300	120	130
Mercury	1.7	3.0	3.3	3.2	6.0	30	1.7
Nickel	3,000	900	1,900	2,000	2,700	2,500	1,700
Phosphorus	NA	NA	NA	NA	NA	NA	NA
Potassium	1,500	1,700	1,300	1,600	1,200	1,400	1,300
Silver	<80.0	<50.0	<90.0	<50.0	<100	<100	<70.0
Sodium	900	900	700	1,000	1,600	2,800	700
Strontium	200	130	160	160	430	180	140
Vanadium	<70.0	<80.0	70.0	100	<50.0	<100	<50.0
Zinc	22,000	27,000	25,000	47,000	52,000	61,000	20,000
PCB	NA	NA	NA	NA	NA	NA	NA
Aliphatic hydrocarbons	NA	NA	NA	NA	NA	NA	NA
Alkylbenzenes	NA	NA	NA	NA	NA	NA	NA
Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA
Dichlorophenol	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons	NA	NA	NA	NA	NA	NA	NA
Naphthalenes	NA	NA	NA	NA	NA	NA	NA
Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA

Table 1. Chemical analysis of soils (in ppm, dry weight materials) (cont)

Parameters	Sample number						
	X115	X116	X117	X118	X119	X120	X121
Aluminum	9,000	9,000	1,300	1,200	NA	NA	NA
Arsenic	18.0	9.0	16.0	15.0	NA	NA	NA
Barium	3,400	300	400	1,600	510	1,200	230
Berylium	<7.0	<2.0	<2.0	<2.0	1.0	1.0	<1.0
Boron	<20.0	<20.0	<10.0	6.0	<10.0	<10.0	<10.0
Cadmium	120	<20.0	<30.0	<20.0	7.0	3.0	1.0
Calcium	11,000	5,000	1,600	6,000	7,300	72,000	11,000
Chromium	120	130	<40.0	<30.0	36.0	38.0	<10.0
Cobalt	40.0	<10.0	<20.0	<4.0	9.0	10.0	9.0
Copper	22,000	270	160	1,000	100	150	100
Iron	40,000	12,000	2,400	4,300	17,500	16,200	16,500
Lead	3,200	80.0	<40.0	100	43.0	60.0	<20.0
Magnesium	5,000	2,600	1,200	1,000	4,500	4,300	5,900
Manganese	150	60	40.0	50.0	260	350	370
Mercury	4.0	0.2	2.0	2.0	NA	NA	NA
Nickel	2,400	140	<20.0	<15.0	<10.0	80.0	120
Phosphorus	NA	NA	NA	NA	NA	NA	NA
Potassium	1,500	2,300	850	1,200	1,800	1,200	1,500
Silver	<100	<50.0	50.0	<50.0	<10.0	<10.0	<10.0
Sodium	1,100	360	150	180	110	225	80.0
Strontium	200	40.0	<30.0	<30.0	42.0	140	32.0
Vanadium	150	<50.0	<40.0	<50.0	27.0	27.0	25.0
Zinc	71,000	2,500	<50.0	300	2,000	700	230
PCB	NA	NA	NA	NA	1.1	80.0	<.05
Aliphatic hydrocarbons	NA	NA	NA	NA	BDL	BDL	BDL
Alkylbenzenes	NA	NA	NA	NA	BDL	BDL	BDL
Dichlorobenzene	NA	NA	NA	NA	BDL	BDL	BDL
Dichlorophenol	NA	NA	NA	NA	BDL	BDL	BDL
Hydrocarbons	NA	NA	NA	NA	BDL	BDL	BDL
Naphthalenes	NA	NA	NA	NA	BDL	BDL	BDL
Trichlorobenzene	NA	NA	NA	NA	BDL	BDL	BDL

Table 1. Chemical analysis of soils (in ppm, dry weight materials) (cont)

Parameters	Sample number							
	X122	X123	X124	X125	X126	X127	X128	X129
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	29.5	95.8
Barium	5,500	4,400	350	2,500	5,000	2,500	NA	NA
Berylium	2.0	3.0	1.0	<1.0	2.0	2.0	NA	NA
Boron	<10.0	<10.0	25.0	<10.0	76.0	<10.0	NA	NA
Cadmium	35.0	40.0	4.0	6.0	70.0	50.0	50.6	22.11
Calcium	15,000	12,500	4,500	6,900	19,000	8,000	NA	13,095
Chromium	50.0	150	50.0	50.0	100	340	140	491
Cobalt	15.0	15.0	7.0	9.0	50.0	30.0	NA	NA
Copper	21,900	18,700	4,500	1,000	44,800	28,000	5.5	24,324
Iron	50,000	49,000	13,500	7,000	107,000	63,000	29,535	51,911
Lead	1,700	1,400	130	260	2,000	1,700	843	2,604
Magnesium	3,800	3,400	3,500	380	3,700	2,700	NA	2,088
Manganese	190	200	80.0	45.0	280	150	141	245
Mercury	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1,700	1,600	590	130	3,000	NA	569	1,474
Phosphorus	NA	NA	NA	2,000	8,900	4,700	NA	NA
Potassium	960	950	1,000	770	860	1,000	NA	NA
Silver	30.0	30.0	6.0	<10.0	100	40.0	29.0	98.0
Sodium	630	650	100	80	1,400	700	NA	NA
Strontium	190	175	27.0	50.0	300	130	NA	NA
Vanadium	45.0	42.0	19.0	13.0	85	45.0	NA	NA
Zinc	19,900	17,700	2,600	1,500	62,000	28,000	NA	NA
PCB	540	1,100	24.0	10,000	350	73.0	2.2	13.0
Aliphatic hydrocarbons	BDL	BDL	BDL	BDL	BDL	BDL	13.0	26.0
Alkylbenzenes	BDL	BDL	BDL	370	BDL	BDL	BDL	BDL
Dichlorobenzene	0.35	23.0	BDL	660	BDL	BDL	BDL	1.7
Dichlorophenol	BDL	BDL	BDL	170	BDL	BDL	BDL	BDL
Hydrocarbons	BDL	BDL	BDL	21,000	BDL	BDL	BDL	BDL
Naphthalenes	BDL	BDL	BDL	650	BDL	BDL	BDL	BDL
Trichlorobenzene	BDL	BDL	BDL	78	BDL	BDL	BDL	BDL

NA - not attempted
BDL - below detection limit
All samples taken between 9/8/80 and 11/26/80

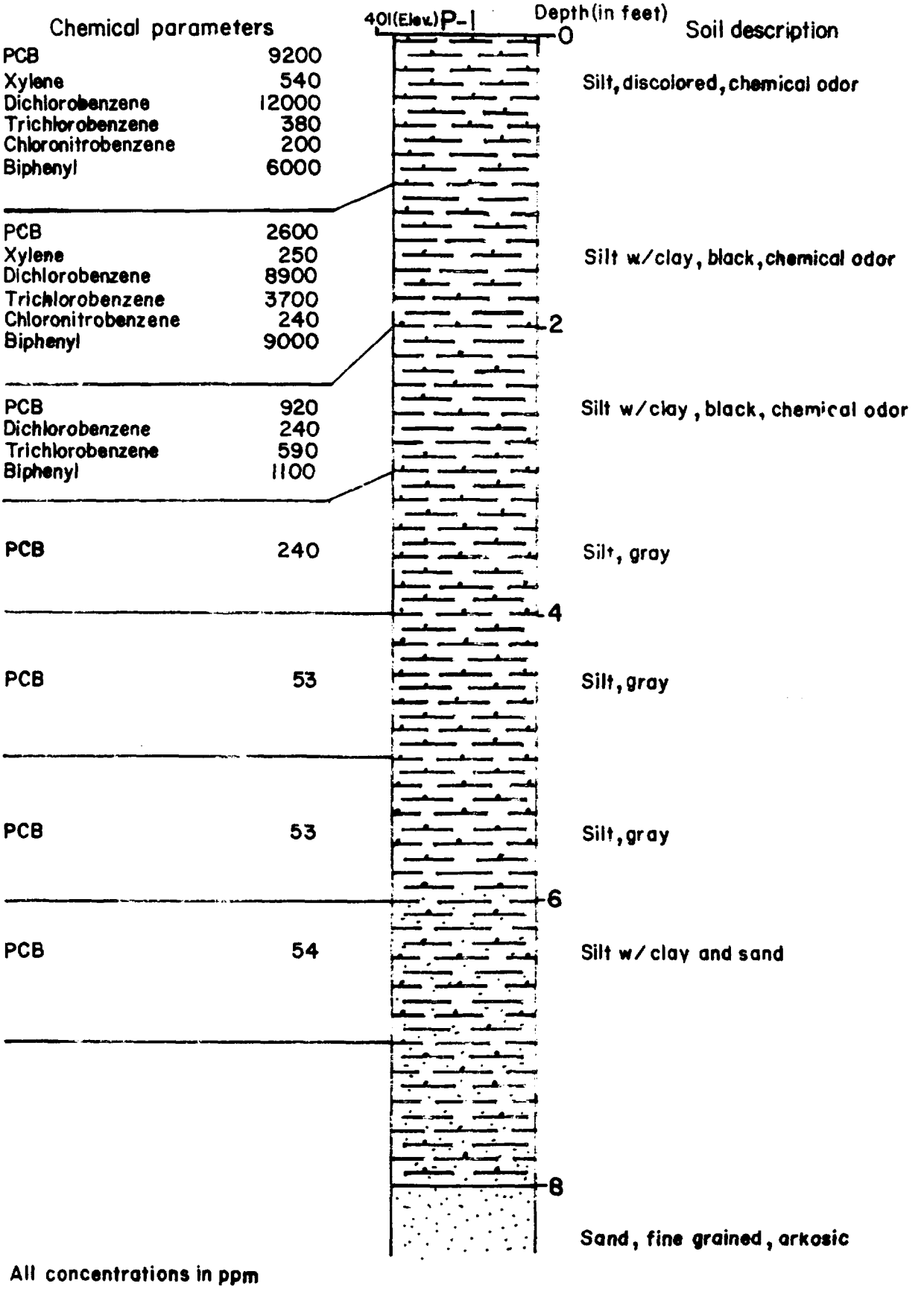


Figure 7a. Vertical distribution of organic chemicals in the creek bottom at P-1

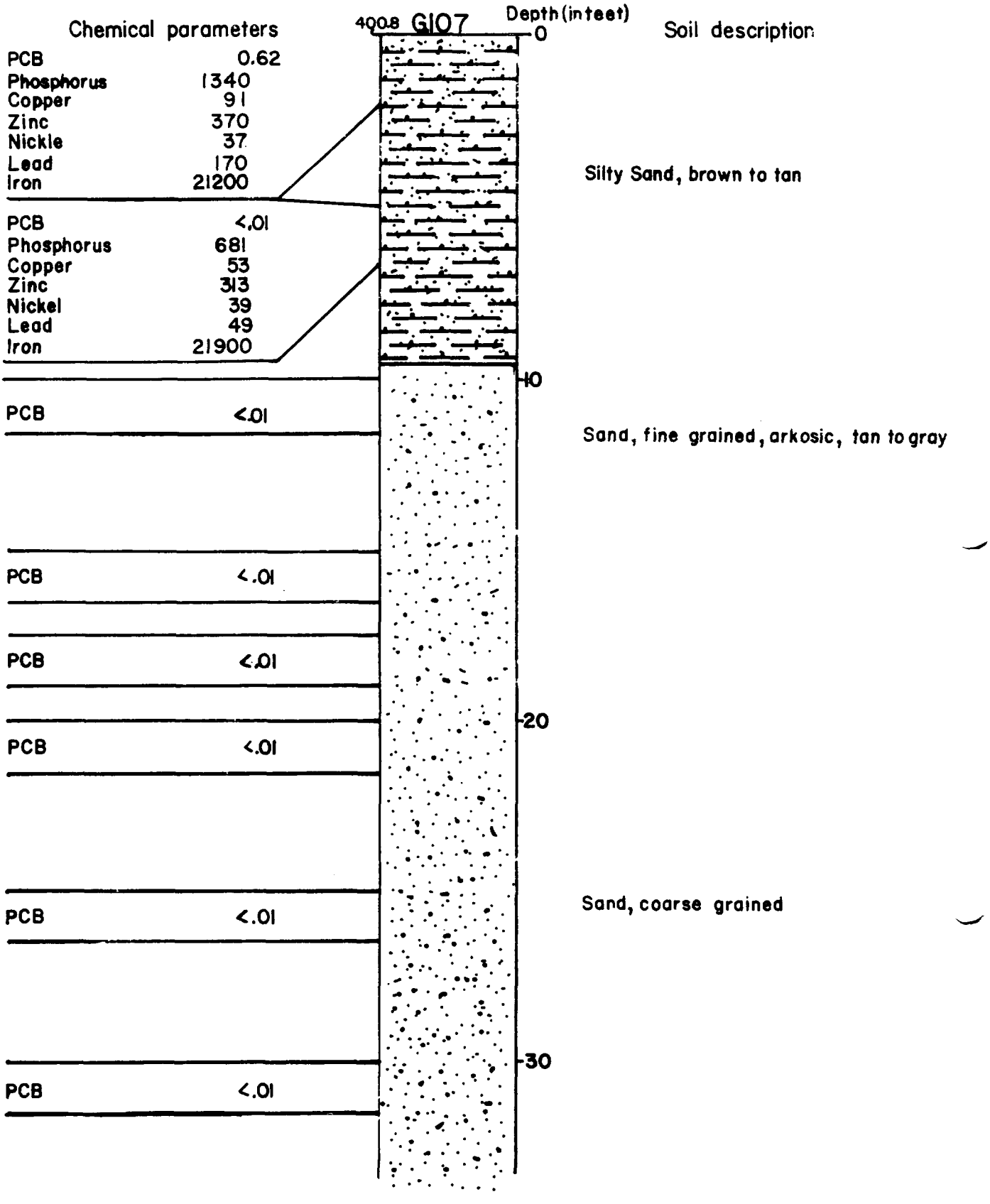


Figure 7b. Vertical distribution of PCB's and metals at G107

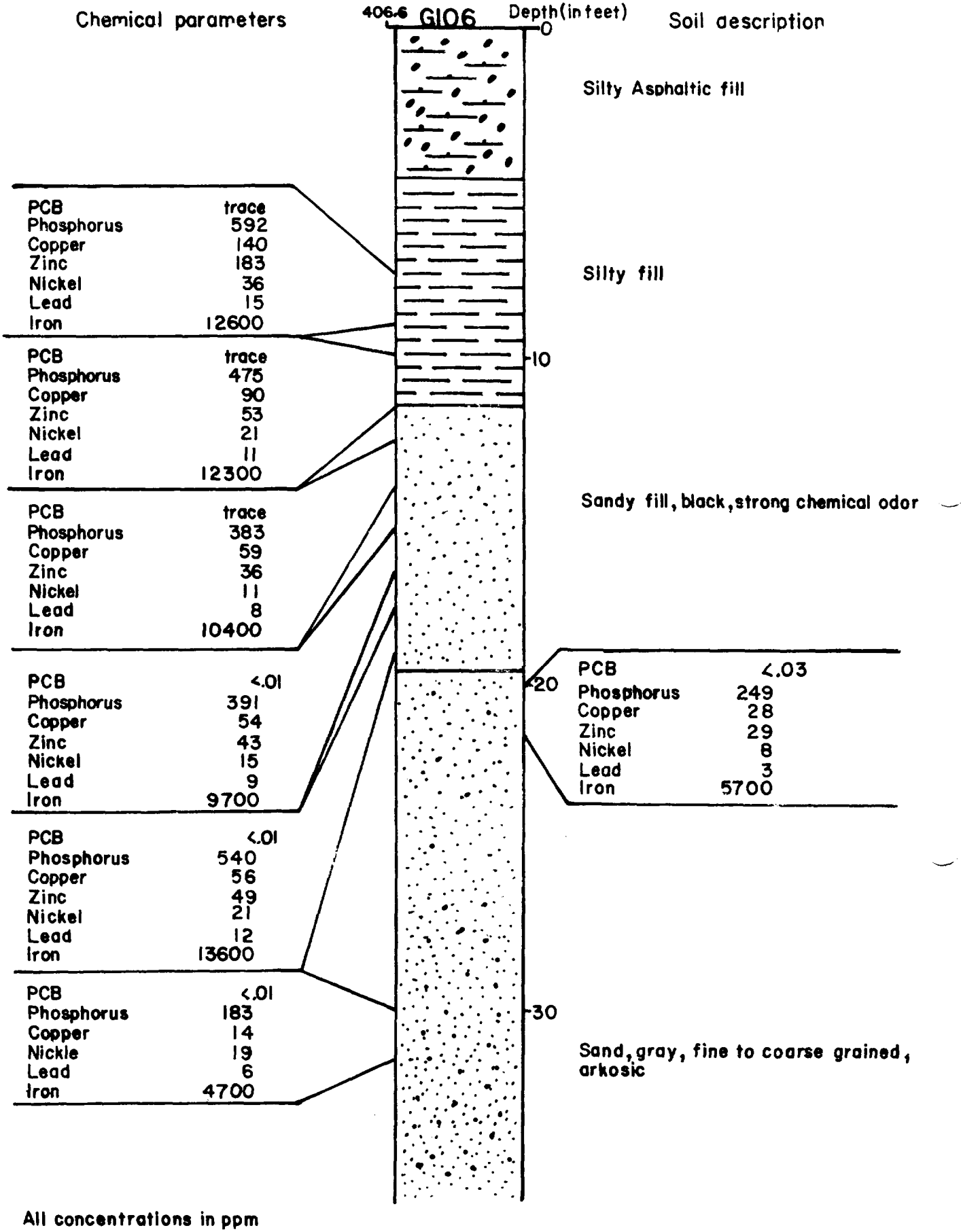


Figure 7c. Vertical distribution of PCB's and metals at G106

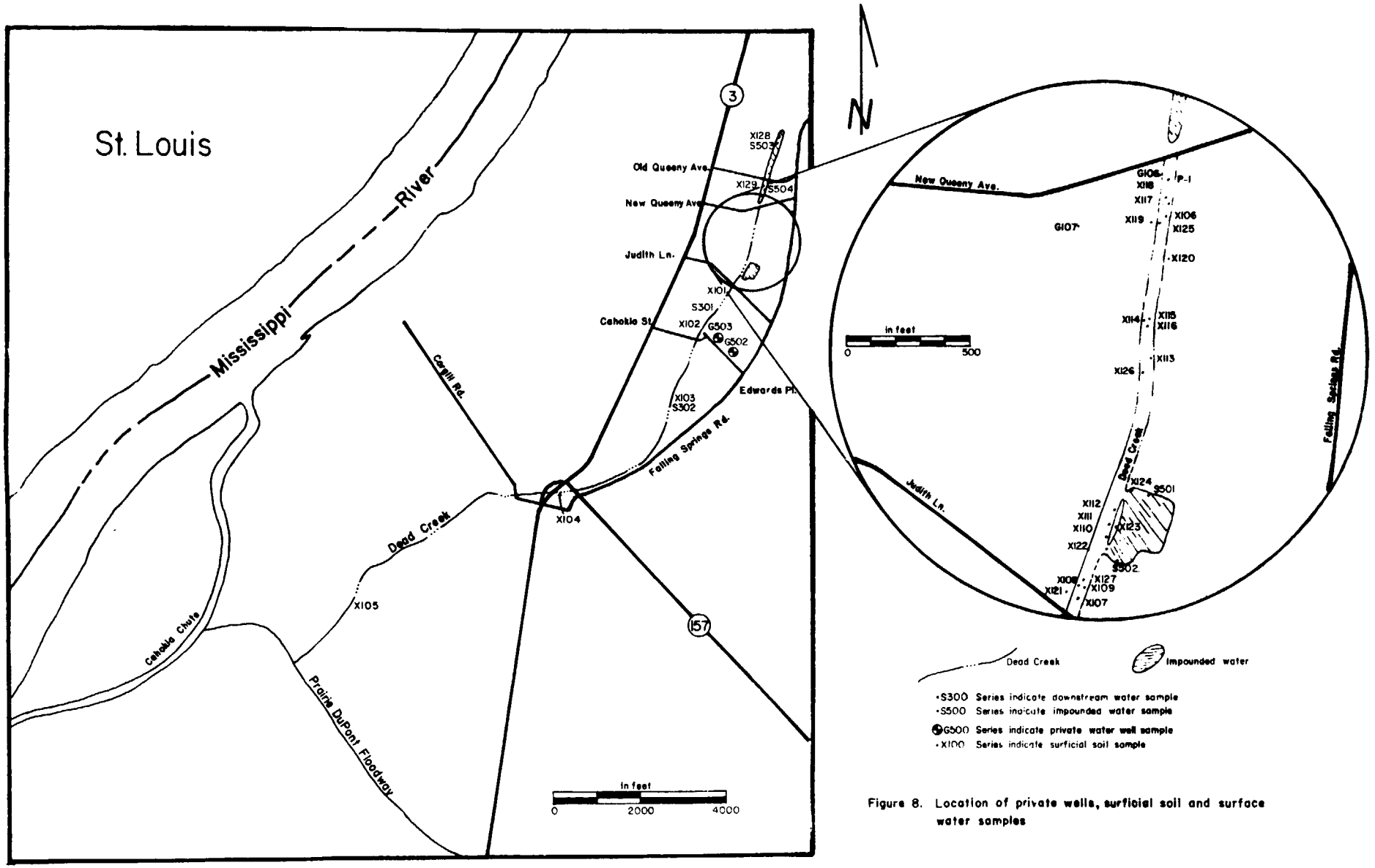


Figure 8. Location of private wells, surficial soil and surface water samples

nickel, sodium, strontium, and zinc. In fact, the highest concentrations of aluminum (12,000 ppm) and boron (76 ppm) are associated with these downstream soil samples. The relatively high concentrations in the downstream soil samples is due to transportation by the creek of the soils from upstream. It is noticed that at some locations concentrations are higher even though they are further downstream (X104 compared to X103). This can be attributed to dynamic properties of stream flow such as gradient, channel depth, and channel form. Besides the creek soils, unknown waste disposal activities at downstream locations might cause the high concentrations in soils. The only organic chemical to show up downstream was PCB, and it ranged from less than .05 ppm at X105 to 2.8 ppm at X103.

Soil samples taken in the creek bed between New Queeny Avenue and Judith Lane can be grouped into three areas (Figure 8), north, central, and south. Samples X106, X117, X118, X125, and the first sample of P-1 are surficial soil samples at the north end of the creek. When compared to the background sample X121, the analyses from the five samples above indicate that they contain very high levels of organic chemicals. The highest concentrations are PCB (10,000 ppm), dichlorobenzene (12,000 ppm), xylene (540 ppm), trichlorobenzene (380 ppm), chloronitrobenzene (200 ppm), biphenyl (6,000 ppm), dichlorophenol (170 ppm), alkylbenzenes (370 ppm), naphthalenes (650 ppm), and hydrocarbons (21,000 ppm). Although concentrations of these chemicals show drastic changes from one sample to another in the same area, it appears that sample P-1 has the highest concentration of organics. Most of the organics are not detected in samples X106 even though it is close to samples X125 and P-1. The difference is probably caused by both the creek bed topography, where an accumulation of organics has occurred in depressions and/or differences in permeability of the creek bed soils that might cause differential migration of organics downward from the soil surface. Inorganic chemicals are relatively high in comparison to the background sample in the northern part of the creek as well.

Five soil samples,X113, X114, X115, X116, and X126, were taken in the central portion of Dead Creek. Among these, only X126 was analyzed for organics and was found to contain only PCB (350 ppm). Analysis results indicate that this area contained very high levels of inorganics. The highest concentration for cadmium (400 ppm), cobalt (100 ppm), iron (365,000 ppm), mercury (30 ppm), sodium (2,800 ppm) are associated with X113. In addition, the highest concentration of zinc (71,000 ppm) was found at X115, chromate (400 ppm) at X114, and that of boron (76 ppm), copper (44,800 ppm) and phosphorus (8,900 ppm) at X126. In general, inorganic chemicals in this portion of the creek exceed background levels by several times.

Soil samples X107, X108, X109, X110, X111, X112, X122, X123, and X124 were taken in the southern part of the creek and near the pond. PCB was found in relatively high concentrations in X107 (120 ppm), X122 (540 ppm), X123 (1,100 ppm), X124 (24 ppm) and X127 (73 ppm). Also, 0.35 ppm and 23 ppm dichlorobenzene was found in X122 and X123, respectively. As for inorganics, the highest concentration of barium (8,000 ppm), lead (5,100 ppm), and strontium (430 ppm) are at X112, nickel (3,500 ppm) at X107, and that of vanadium (100 ppm) at X111. In general, the other inorganics are relatively high and above the background (X121) concentrations.

Vertical Distribution

Vertical distribution of chemicals in soils is examined in three locations, G106, G107, and P-1 (Figure 8), the results are presented in Figures 7a, 7b, and 7c.

Inorganic chemicals are analyzed in two locations, G106 and G107, to obtain data outside the creek bed itself. At G106, traces of PCB are shown in the upper three intervals. The metal concentrations show a general decrease with depth, however, analysis at G106 indicates that the metal concentrations of the upper silty fill and the sand immediately below are almost the same. At G107, only the two uppermost samples have been analyzed for metals, and although the data is incomplete, it seems metals and PCB increases with depth. Soils at G107 seem to contain a higher concentration of chemicals than those at G106. This would suggest waste disposal activity nearby. Presently, there is an open dump north of G107. This dump is bounded by the Weise Machinery building on the west, G107 on the south, New Queeny Avenue on the north, and G106 on the east.

Soil samples from P-1, located at the northern part of the creek bed, were analyzed for organics. The three surficial soil samples, to a depth of 3 feet, contain large amounts of PCB and organics. Below this interval, a decrease of organic chemicals is noted with depth, though there is a slight discrepancy with trichlorobenzene and chloronitrobenzene. Except PCB, other organics are not found below 3 feet in depth. Analyses indicate that most of the organics are confined to surficial soils and do not tend to travel vertically. This is probably due to both clay content of surficial soils, and the relatively low solubility of chlorinated hydrocarbons and their associated by products. PCB's show a slight vertical migration that probably reaches the Henry Formation sands and thus the ground water in minor amounts. Outside the creek bed very low amounts of PCB were found but other organics were not; inorganics appear to have traveled downward to some degree.

Ground Water

Aquifer

As stated previously, the Henry Formation sands are the major aquifer in the area. At the creek itself these valley train sands, on an average, rise to within 14 feet of surface. Figures 6a and 6b show the potentiometric level plotted at the site in cross section. It is seen by these cross sections that most of the ground water occurs in the Henry Formation sands. Exceptions occur in the northern and southern portions of the creek where the silt mantle thickens (Figure 6a, A-A') and the ground water level encounters it.

Water table as opposed to leaky artesian conditions (Bergstrom, 1956) prevail at the site because the lower portion of the alluvial silt is permeable enough (5.4×10^{-3}) not to impede vertical movement of the ground water.

The potentiometric surface map, Figure 9, indicates that the hydraulic gradient is very flat in the vicinity of Dead Creek. The gradient is 3'/1060' or .00283 generally moving to the west but with local fluctuations apparent. Periodic measurement of the potentiometric surface appear in Table 2. The following is a brief discussion of potential pollution sources and their impact on ground water.

Table 2. Ground water elevations in IEPA monitor wells, all elevations in feet above mean sea level

Well number	Measurement dates				
	10/22/80 10/23/80	10/30/80	10/31/80	1/28/81	2/18/81
G101	393.02	393.22	393.42	391.82	391.52
G102	394.29	394.49	394.09	392.79	392.69
G103	394.40		393.70	393.00	392.70
G104	393.60	393.70	393.40	390.60	392.00
G105	394.81	394.91	394.51	393.31	392.91
G106	394.17	394.17	394.87	392.57	392.77
G107	390.05	393.35	391.05	392.75	391.85
G108	395.06	395.26	394.16	394.26	393.96
G109	394.38	394.18	393.78	392.68	392.18
G110	394.74	394.64	394.34	393.44	393.04
G111		394.21	393.91	393.21	392.61
G112		394.32		392.32	392.22

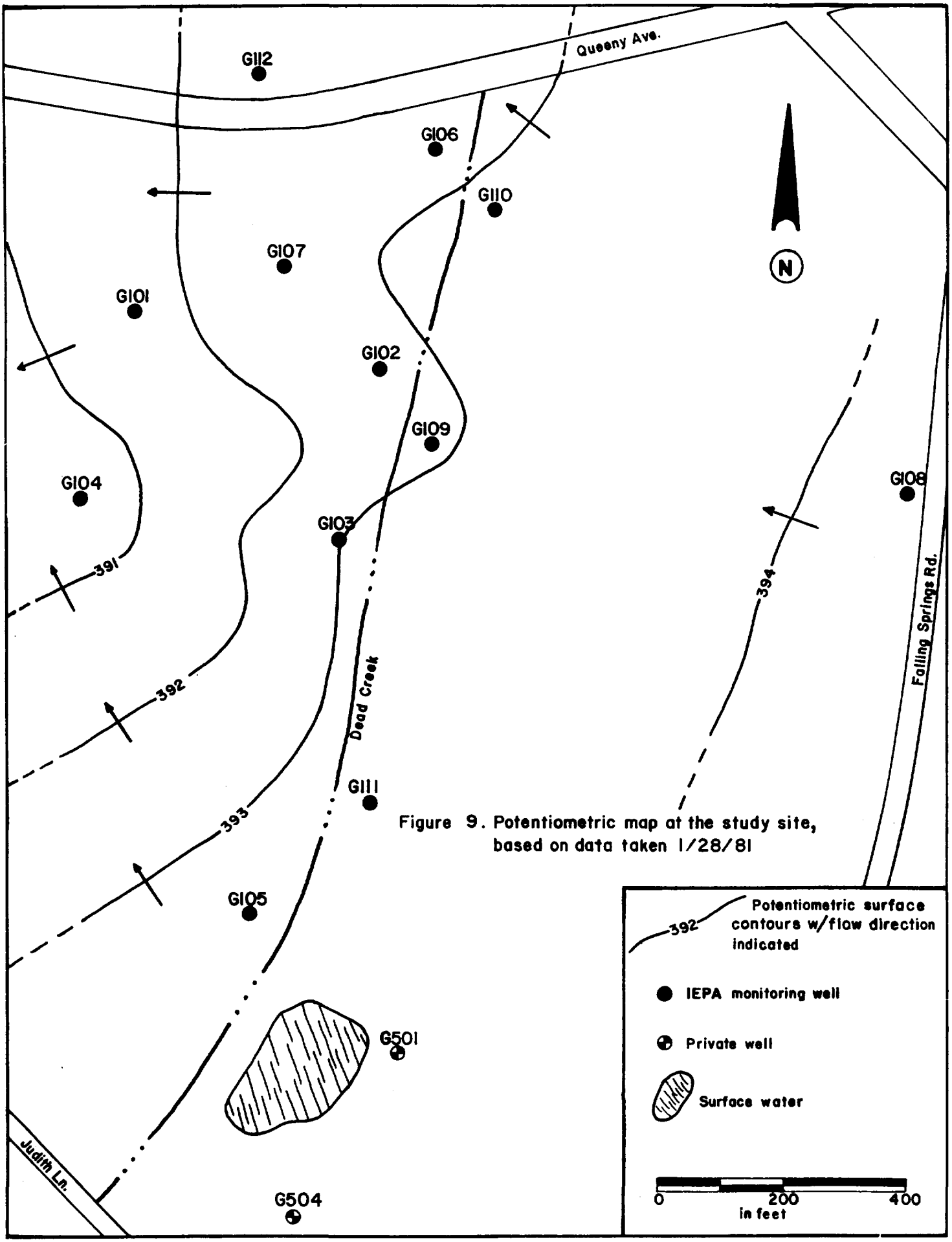


Figure 9. Potentiometric map at the study site, based on data taken 1/28/81

Dead Creek

Conditions in the creek are suspected of being a major contributor to ground water pollution. As seen in Figure 6b (cross sections C-B' and B-B'), the water table is just at the bottom of the creek fill material. This level is at its lowest point for the year though. Using information gathered from another site in the American Bottoms (East St. Louis/SCA-Milam), this level can be expected to rise approximately 3.65 feet at its peak level of the year. When this occurs, polluted fill material comes in contact with ground water. The ground water at this time produces a washing of these pollutants from the creek fill. Darcy's equation allows us to calculate the rate of flow beneath the creek in the sand aquifer and thus the rate at which these pollutants are washed away.

Darcy's equation: $Q = K \times \frac{dh}{dl} \times A$ where,

Q = flow rate
K = hydraulic conductivity (permeability)
$\frac{dh}{dl}$ = hydraulic gradient
A = cross section area through which water flows perpendicular to

At the creek the following conditions exist:

K = the average permeability of the aquifer is given to be 4.4×10^{-3} cm/sec or 4454 ft/year

$\frac{dh}{dl}$ = the hydraulic gradient is determined to be .00282

A = the area perpendicular to flow, using the 3.65 foot rise of the water table is 7210 square feet.

This data yields the following:

$$Q = K \times \frac{dh}{dl} \times A$$

$$Q = (4554 \text{ ft/year}) \times (.00283) \times (7210 \text{ ft}^2)$$

$$Q = 92{,}921 \text{ ft}^3\text{/year or } 1.32 \text{ gal/min}$$

At the same time an approximation of velocity, V, can be calculated for the water in the aquifer. This is the velocity at which the pollutants contributed by the creek move away from it. Here,

$$V = K \times \frac{dh}{dl} \times \frac{1}{N} \text{ where}$$

V = velocity and N = effective porosity.

It is assumed that the effective porosity of the Henry Formation sands is 0.20 (Walton, 1970) which gives the following:

$$V = (4554 \text{ ft/year}) \times (.00283) \times \frac{1}{0.20} = 64.4 \text{ ft/year or } 0.18 \text{ ft/day}$$

The period of time required for surface water to infiltrate the bottom of the creek and travel through the fill to ground water can be calculated from:

$$T = \frac{L}{V} \text{ where,}$$

T = time required
L = distance traveled (thickness of layer)
V = velocity

The velocity of water movement through the fill can be calculated by the equation used previously. If it is assumed that the fill material with a permeability of 1.0×10^{-6} has an effective porosity of .10 and thickness of 8 feet under unit hydraulic gradient, this yields:

$$V = K \times \frac{dh}{dl} \times \frac{1}{N} \text{ and}$$

$$V = (1.03 \text{ ft/year}) \times (\frac{8 \text{ ft}}{8 \text{ ft}}) \times \frac{1}{.10} = 10.30 \text{ ft/year or } .0282 \text{ ft/day}$$

The time required for movement of water through the fill can now be calculated in the northern part of the creek where the fill is 8 feet thick as,

$$T = \frac{L}{V}$$

$$T = \frac{8 \text{ feet}}{10.30 \text{ ft/year}} = .777 \text{ years or } 284.0 \text{ days}$$

and at the south end of the creek where the fill material thickens to 10 feet as,

$$T = \frac{L}{V}$$

$$T = \frac{10}{10.30 \text{ ft/yr}} = .9708 \text{ years of } 354.0 \text{ days}$$

This means that if the fill in the creek is saturated and there is only a film of liquid in the creek, that it will take between 284 to 354 days to reach the ground water. However, if large amounts of liquid wastes are disposed of in the creek or much water exists in the creek after a rain, vertical migration is probably much more rapid.

Due to complexities involving surrounding surface runoff and infiltration percentage of precipitation, the flow rate through this layer cannot be calculated.

Holding ponds at Cerro Copper

Prior to blocking the culvert at New Queeny Avenue the impounded waters on Cerro Copper were once the head waters for Dead Creek. Because of this, it is assumed that the morphology is similar and that the time required for the impounded water to infiltrate through the creek fill is much less than that calculated for the northern portion of the creek, 284 days. This is because the impounded water results in a larger head and increases the velocity of the ground water movement. Becker (1975) identified four outfalls entering this pond from the Cerro Copper plant.

The Disposal Impoundment

As seen in a 1973 map by the U.S.A.C.E. (St.Louis District), the area of the disposal impoundment is approximately 20,000 square feet. The wastes dumped into it and the later leaching by rain water are then sources of potential ground water pollution here.

Mr. Waggoner stated in 1971 that he used approximately 100 gallons of water per day to wash out his trucks that carried industrial waste. This is most likely a conservative estimate. He operated in this manner from August, 1971 until sometime in 1974, when he sold the company to Ruan Trucking Company, who continued the same practice until 1978. If it's assumed that they "washed their trucks out" 5 days a week during this period of time, the following estimate as to the amount of disposal can be made:

(100 gal/day) x (6.3 years) x (52 weeks/year) x (5 days/week) = 163,800 gallons

It is felt that this excavation caused large amounts of ground water pollution, as seen from the above value, and from the drilling of monitor well G109 (Figure 4). While drilling it, the driller and his assistant operating the rig became nauseous from the fumes. These conditions were due to its location in a small strip of virgin soil between the creek and the disposal impoundment. Since the soils above the water table are relatively clean until encountering the ground water, and no mounding is shown at this well location, it must be assumed that the disposed liquids migrated vertically from the impoundment. Upon encountering the ground water table, pollutants traveled in the direction of ground water flow (to the west), and reached well G109.

The Pond Occupying H. H. Hall Construction's Sand Pit

The water level in this pond is 1.5 to 2.0 feet higher than the closest wells to it (G111, G105), therefore, it is assumed that the water in the pond has no hydrological connection to the ground water aquifer. Since this pit was excavated to obtain the Henry Formation sands, it at one time must have extended down to the aquifer. The only explanation for this breech then, is that the pond has silted in to the point where the water in the pond is of a perched nature. This silting action occurred in the same way as that previously described for the creek bottom. Evidence for the deposition of this silt fill in recent times occurs at the Judith Lane culvert. This culvert (with a diamter of 6 feet) was installed in the early 1950's to allow for better creek flow under the road. Subsequent sedimentation in the creek has filled to within one foot of the top of this culvert. This means that the water level in the pond fluctuates independently of the ground water aquifer.

Water Quality

Ground Water

The monitoring wells installed by the IEPA have been sampled twice during this study. The location of these wells are shown on Figure 4, and analysis results are presented in Tables 4a and 4b. In addition to these wells, four private wells (Figures 4 and 8) have been sampled to establish the background quality. Water samples were collected and preserved according to the Agency standards, however, the samples were not filtered. Analysis for the background is in

Table 3. Ground water quality in private wells (background), concentrations in ppm except where noted

Parameters	Ground water standards	Collection date and well number			
		9/16/80 G501	9/16/80 G502	9/16/80 G503	9/23/80 G504
Arsenic	0.05	0.008	0.004	0.001	< 0.001
Barium	1.0	0.2	0.16	0.39	0.05
Boron	1.0	0.28	0.27	0.25	0.58
Cadmium	0.01	<0.001	< 0.005	<0.002	< 0.002
Chromium	1.05	<0.01	< 0.005	< 0.01	NA
Copper	0.02	0.02	< 0.005	< 0.005	0.06
Iron	1.0	4.6	19.0	17.7	0.73
Lead	0.05	< 0.02	< 0.02	< 0.05	< 0.04
Magnesium	NE	33.0	39.0	36.0	30.0
Manganese	0.15	1.02	1.26	0.79	0.65
Mercury	0.0005	< 0.0001	< 0.0001	< 0.0001	0.0001
Nickel	1.0	< 0.005	< 0.0005	< 0.01	0.02
Phosphorus	0.05	< 1.0	< 1.0	< 1.0	0.2
Potassium	NE	6.6	5.7	4.5	6.0
Silver	0.0005	< 0.005	< 0.005	<0.005	< 0.01
Sodium	NE	21.0	24.0	12.0	26.0
Zinc	1.0	0.85	NA	0.18	0.8
PCB (ppb)	NE	NA	NA	NA	< 0.1

NE - Not established
NA - Not attempted

Table 4b. Analysis of [illegible] d water samples from the IEPA monitoring w[illegible]n 1/28/81 in ppm except when noted

PARAMETERS	STANDARDS	GI01	GI02	GI03	GI04	GI05	GI06	GI07	GI08	GI09	GI10	GI11	GI12
Alkalinity	NE	447	421	266	520	363	556	621	448	18	308	394	619
Ammonia	1.5	0.3	0.0	1.4	0.2	0.7	3.3✓	1.0	0.0	17✓	0.2	0.1	0.5
Arsenic	0.05	0.015	0.016	0.018	0.002	0.037	0.11	0.021	0.004	7.5✓	0.013	0.014	0.027
Barium	1.0	0.9	1.2✓	0.9	0.3	1.8✓	1.0	3.2✓	0.5	0.2	1.0	0.7	0.5
Boron	1.0	0.3	0.4	0.4	0.7	0.4	0.5	0.5	0.2	0.8	0.2	0.6	0.9
Cadmium	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14✓	0.00	0.00	0.00
Calcium	NE	220.0	328.9	176.3	218.0	319.2	225.5	1169.5	205.5	466.7	169.4	181.4	198.3
C.O.D.	NE	45	93	56	9	143	212	635	8	1315	37	28	47
Chloride	250	20	128	64	29	59	156	201	76	32	36	18	210
Chromium (total)	1.05	0.02	0.02	0.02	0.00	0.03	0.00	0.09	0.00	0.04	0.02	0.02	0.00
Chromium (+6)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	0.02	0.59✓	0.79✓	0.36✓	0.14✓	0.43✓	0.29✓	0.97✓	0.00	94.1✓	0.11✓	0.04✓	0.28✓
Cyanide	0.025	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Fluoride	1.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hardness	NE	554	1072	490	717	764	617	960	564	2144	447	530	486
Iron	1.0	30.4✓	16.5✓	20.8✓	1.4✓	60.8✓	67.5✓	172✓	0.3	198✓	19.1✓	10.7✓	18.9✓
Lead	0.05	0.17✓	0.08✓	0.00	0.00	0.07✓	0.00	0.32✓	0.00	0.00	0.00	0.00	0.00
Magnesium	NE	48.2	78.0	46.3	49.1	73.6	49.1	288.1	34.3	184.4	43.5	37.9	54.0
Manganese	0.15	3.02✓	3.15✓	3.07✓	1.41✓	4.10✓	2.13✓	9.64✓	0.34✓	8.30✓	0.77✓	1.76✓	2.78✓
Mercury	.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0
Nichel	1.0	0.1	0.1	0.4	0.0	0.2	0.0	0.5	0.0	176✓	0.9	0.0	0.0
Nitrate - nitrite	10.0	0.0	2.5	0.1	0.5	0.0	0.0	0.2	3.5	0.3	18✓	0.5	0.0
pH	6.5 - 9.0	7.0	7.0	7.1	7.2	7.0	6.9	6.9	7.1	4.1✓	6.9	7.0	6.9
Phenolics	.001	0.0	0.0	0.0	0.0	0.0	1.46✓	0.5✓	0.01✓	1.86✓	0.02✓	0.015✓	0.05✓
Phosphorous	0.05	0.91✓	0.88✓	0.41✓	0.06✓	3.6✓	2.1✓	10✓	0.03	3.7✓	1.0✓	0.51✓	0.53✓
Potassium	NE	6.4	12	8.8	6.0	13	6.2	20	16	18	7.5	4.2	20
R.O.E.	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.01	0.002	0.002	0.002	0.002	0.003	0.002	0.011✓	0.004	0.006	0.016✓	0.002	0.0
Silver	.005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	NE	13	63	48	15	50	94	60	30	37	13	14	18
S.C.	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	250	129	583✓	256✓	265✓	468✓	143	276✓	86	3371✓	57	153	212
Zinc	1.0	0.3	1.2✓	1.8✓	0.1	1.5✓	0.1	1.5✓	0.0	10.1✓	2.0✓	0.1	2.8✓
PCB (ppb)	NE	0.22✓	3.9✓	NA	0.3✓	BDL	NA	0.4✓	BDL	NA	NA	NA	BDL
Chlorobenzene (ppb)	NE	NA	NA	NA	NA	NA	NA	63✓	BDL	BDL	NA	NA	25✓
Dichlorophenol (ppb)	NE	NA	NA	NA	NA	NA	NA	560✓	BDL	BDL	NA	NA	BDL
Chloroaniline (ppb)	NE	NA	NA	NA	NA	NA	NA	90✓	BDL	BDL	NA	NA	21✓

✓ indicates above standard amounts

NA= Not Attempted

NE=Not Established

BDL= Below Detection Level

Table 4a. Analysis of gr(water samples from the IEPA monitoring wells on (3/80 in ppm except when noted

PARAMETERS	STANDARDS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	NE	362	410	336	406	271	387	552	375	287	210	302	699
Ammonia	1.5	0.3	1.6✓	1.7✓	0.4	0.9	2.9✓	0.5	0.3	4.5✓	1.2	0.1	1.5
Arsenic	.05	.023	.023	.043	.049	.067✓	.16✓	.043	.008	.055✓	.053✓	.008	.019
Barium	1.0	1.3✓	0.8	2.9✓	2.2✓	2.0✓	0.6	2.1✓	0.3	0.2	0.5	0.2	0.5
Boron	1.0	0.5	0.4	0.5	0.6	0.4	0.5	0.5	0.4	0.4	0.5	0.5	5.6✓
Cadmium	.01	0.0	0.0	.03✓	0.0	0.0	0.0	0.0	0.0	0.0	1.5✓	0.0	.06✓
Calcium	NE	180	210	210	210	340	185	500	140	380	500	110	242
C.O.D.	NE	237	160	244	206	473	115	1070	298	275	780	79	162
Chloride	250	48	103	56	52	65	109	132	79	69	61	32	363✓
Chromium (total)	1.05	.04	.02	.09	.04	.12	.01	.07	0.0	0.0	.38	0.0	.01
Chromium (+6)	.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	.02	.46✓	.13✓	1.1✓	.31✓	.73✓	.44✓	.68✓	.04✓	.13✓	2.3✓	.04✓	1.2✓
Cyanide	.025	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0
Fluoride	1.4	0.4	0.7	0.7	0.3	1.0	0.7	0.7	0.3	1.2	0.8	0.3	0.5
Hardness	NE	501	884	549	630	528	637	777	496	1664	279	419	1080
Iron	1.0	51.0✓	39.5✓	86✓	89✓	18✓	62✓	13✓	4.1✓	39.0✓	340✓	5✓	18✓
Lead	.05	.19✓	.15✓	0.26✓	0.2✓	0.31✓	0.0	0.27✓	0.0	0.0	7.3✓	0.07✓	0.44✓
Magnesium	NE	69	90	79	72	100	49	205	24	100	209	24	82.5
Manganese	.15	5.1✓	3.8✓	4.2✓	3.4✓	4.2✓	1.9✓	9.8✓	0.98✓	4.5✓	8.8✓	1.1✓	3.9✓
Mercury	.0005	0.0	0.0	.0002	0.0	0.0	0.0	0.0	.0001	0.0	0.0	0.0	.0001
Nickle	1.0	0.1	0.1	0.9	0.1	0.8	0.1	0.3	0.0	0.5	1.9✓	0.0	0.3
Nitrate-nitrite	10.0	0.1	0.1	0.1	0.4	0.0	0.1	0.1	1.1	0.0	0.4	0.5	0.0
pH	6.5-9.0	6.6	6.6	6.5	6.6	6.6	6.5	6.4✓	6.6	6.3✓	6.7	7.0	6.4✓
Phenolics	.001	0.0	.01✓	0.0	.005✓	0.0	.065✓	2.5✓	.01✓	.45✓	.015✓	0.0	.875✓
Phosphorus	.05	2.9✓	1.2✓	3.3✓	2.7✓	6.0✓	1.8✓	9.4✓	.18✓	.72✓	16✓	.24✓	.69✓
Potassium	NE	10.6	13.1	13.4	12.3	22	7.7	15.2	13.7	14.9	29	4.9	58
R.O.E.	500	650✓	1230✓	765✓	790✓	824✓	1020✓	1230✓	704✓	2460✓	508✓	512✓	2190✓
Selenium	.01	.003	.001	.004	.01	.008	.001	.004	.001	.001	.005	.002	.001
Silver	.005	.01✓	0.0	.02✓	0.0	0.0	0.0	0.0	.01✓	0.0	0.0	.02✓	.11✓
Sodium	NE	24	60	40	29	57	96	NA	40	40	53	24	260
S.C.	NE	870	1560	1050	1080	1040	1340	1430	960	2470	720	490	NA
Sulfate	250	132	434✓	230	204	296✓	281✓	201	103	1348✓	93	104	518✓
Zinc	1.0	0.6	0.4	6.2✓	0.3	3.7✓	0.1	0.8	0.0	0.1	9.0✓	0.0	7.8✓
PCB (ppb)	NE	1.0✓	1.2✓	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	2.7✓	< 0.1	< 0.1
Chlorophenol (ppb)	NE	BDL	1200✓	BDL	BDL	BDL	BDL	630✓	BDL	19✓	BDL	BDL	BDL
Chlorobenzene (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	19✓	BDL	BDL	BDL	BDL	100✓
Dichlorobenzene (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	25✓	BDL	BDL	BDL	BDL	65✓
Dichlorophenol (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	890✓	BDL	BDL	BDL	BDL	BDL
Cyclohexanone (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	120✓	5.9✓	BDL	BDL
Chloroaniline (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3500✓

✓ indicates above standard amounts NA = Not Attempted NE = Not Established BDL = Below Detection Limit

Table 3. Because the ground water flow direction is generally east to west, G108 can also be considered a background well. A comparison of the analysis for G108 (Table 4b) with that of G501, G502, G503, and G504 (Table 3) indicates that it indeed is of background quality.

Inorganic chemical parameters analyzed for background quality indicate that iron, manganese, and phosphorus are generally above the State's water quality standards. Organic analysis of these wells showed nothing above the detection limit of 0.1 ppb (Tables 3 and 4b).

In general, results from Table 4a are lower than those found in Table 4b. This is probably due to dilution of samples, which occurred when samples of 4a were collected too soon after drilling and washing of the wells.

Data in Tables 4a and 4b indicates that concentrations of copper, iron, manganese, phosphorus, and R.O.E. exceed the standards and background quality in every well. Lead, phenolics, sulfate and zinc are above the standards in six or more wells.

Among organics analyzed, PCB's were detected in wells G101, G102, and G110. Compared to other wells the relatively high concentrations of 2.7 ppb and 3.9 ppb were found in G110 and G102. Other organics detected such as chlorophenol, chlorobenzene, dichlorobenzene, dichlorophenol, cyclohexanone, and chloroaniline were mostly associated with G107 and G112 even though some other organics were also found in G102, G109, and G110. All these organices are relatively high and not found in the background wells. The organic and inorganic analysis discussed above demonstrate ground water pollution in the area from various sources.

Among the wells, it appears that the ground water in G109 is the most polluted. At G109, ammonia, arsenic, cadmium, copper, iron, manganese, nickel, pH, phenols, phosphorus, R.O.E., sulfate, and zinc exceed the water quality standards by several times. Other parameters for which no standard exists are also in high concentrations. This well is located between Dead Creek and the former disposal impoundment, the exaggerated quantities of ammonia, arsenic, cadmium, copper, nickel, and sulfate must be attributed to this excavation because quantities in other wells directly adjacent to the creek are at least 10 fold less.

Two other wells G112 and G107 exhibit concentrations much above the State Water Quality Standards. One or the other, or both, of the wells show concentrations of barium, boron, copper, iron, lead, manganese, phenols, phosphorus, selenium, sulfate, and zinc above standards. They are also the wells in which organics were detected the strongest. In G107 the two samplings have shown that chlorophenol, chlorobenzene, dichlorobenzene, dichlorophenol, and chloroaniline are present. In G112 chlorobenzene, dichlorobenzene, and chloroaniline have been detected. Since these two wells have these similar characteristics it must be assumed that the pollution source must be common as well. The pollution source is most likely the open dump discussed previously, which lies between the two wells.

Among other highly polluted wells are G110, G106, G105, G103, and G102. Several inorganic parameters are much above the background quality and the standards. Also, some PCB was found in G101 and G102. In G102 chlorophenol was found, and might be explained by its location near the dump which has been suspected of supplying this parameter to wells G107 and G112. Another well, G110, is located between Dead Creek and the believed locations of former sand pits (Figure 4). The only above standard concentration of nitrate (18 ppm) and the

highest concentration of selenium (0.016 ppm) are found in this well. The water quality of this well would be affected by the creek and disposal in one of the sand pits if it indeed did occur.

The wells G102, G103, G105, and G106 are located just on the west side of Dead Creek. All exhibit polluted ground water and are probably affected by the creek. However, G106 might also be affected by the open dump to the west of the well.

When compared to the background quality (G108), monitoring wells G101 and G104 indicate very few signs of pollution. This is probably due to the relatively long distance from the pollution sources in the area, and attenuation of the chemicals during the long flow distance and time.

In conclusion, the chemical analyses of ground water from the monitoring wells indicate the pollution of ground water near Dead Creek, the open dump, and the disposal impoundment. It appears that the effects of the pollution have been reduced somewhat near G101 and G104 which are approximately 400 feet to the west of the creek.

Surface Water

The surface waters in the area of Dead Creek which were sampled and analyzed by IEPA personnel include the holding ponds for Cerro Copper, the pond in the former H. H. Hall Construction sand pit, and the creek waters downstream from Judith Lane. Locations for these samples appear on Figure 8 and analysis is on Table 5.

Analysis of H. H. Hall Construction's pond (S501 and S502) indicate that the water is somewhat polluted showing copper, phosphorus, and iron concentrations slightly above the water quality standards. It also shows PCB's present in minor amounts (0.9 ppb and 4.4 ppb).

Analysis of downstream samples S301 and S302 shows that they too have slightly elevated concentrations of copper and phosphorus when compared to standard and again a minor amount of PCB (1.0 ppb) was detected in S301.

On the other hand, the samples taken from Cerro Copper's holding ponds (S503 and S504) show elevated concentrations of copper, iron, lead, mercury, nickel, phosphorus, silver, and zinc. PCB's (22 and 28 ppb) and aliphatic hydrocarbons (23,000 ppb) were also detected, the latter being the only time in the study. As discussed previously, the ponded water here increases the velocity at which infiltration and vertical movement of water takes place. It then must be assumed that these ponds are contributing a large amount of pollution to the ground water but the present placement of monitoring wells at the site cannot determine this.

Plant Analyses

In an attempt to assess the effects which dumping has had on plant matter, IEPA personnel collected beans, bean leaves, corn, and okra from a garden just west of well G102. They were analyzed for PCB with the following results:

Table 5. Analysis of surface water samples, in ppm except where noted

Parameters	Water quality standards	Collection date and well number 9/15/80 S501	9/15/80 S502	11/26/80 S503	11/26/80 S504	9/25/80 S301	9/25/80 S302
Alkalinity	NE	80.0	85.0	NA	NA	NA	NA
Ammonia	1.5	0.0	0.0	NA	NA	NA	NA
Arsenic	1.0	0.006	0.01	0.058	0.025	0.008	0.006
Barium	5.0	0.2	0.5	1.2	0.7	0.12	0.08
Berylium	NE	NA	NA	NA	NA	<0.001	<0.001
BOD-5	NE	4.0	33.0	NA	NA	NA	NA
Boron	1.0	0.2	0.2	0.20	0.3	0.06	0.04
Cadmium	0.05	<0.002	<0.002	0.36	0.19	<0.005	<0.005
COD	NE	58.0	85.0	NA	NA	NA	NA
Chloride	500	27.0	28.0	NA	NA	NA	NA
Chromium (total)	1.05	<0.005	<0.005	0.61	0.21	<0.01	0.01
Chromium (+6)	0.05	0.0	0.0	NA	NA	NA	NA
Copper	0.02	0.035	0.33	4.5	3.6	0.26	0.04
Cyanide	0.025	0.02	0.0	NA	NA	NA	NA
Fluoride	1.4	0.4	0.4	NA	NA	NA	NA
Hardness	NE	84.0	94.0	NA	NA	NA	NA
Iron	1.0	0.8	1.8	58.0	28.0	0.66	0.87
Lead	0.1	0.0	0.01	6.6	2.8	<0.05	<0.05
Magnesium	NE	6.0	6.0	35.8	28.7	3.0	2.0
Manganese	1.0	0.06	0.82	1.0	0.67	0.03	0.12
Mercury	0.0005	0.0000	0.0	0.0016	0.0016	NA	NA
Nickel	1.0	0.02	0.05	4.2	3.3	0.05	0.01
Nitrate-Nitrite	NE	0.0	0.0	NA	NA	NA	NA
pH	6.5-9.0	7.4	7.0	NA	NA	NA	NA
Phenols	0.1	0.01	0.01	NA	NA	NA	NA
Phosphorus	0.05	0.17	0.31	1.9	3.4	0.19	0.2
Potassium	NE	5.9	6.2	4.3	6.2	6.6	3.3
R.O.E.	1000	201	217	NA	NA	NA	NA
Selenium	1.0	NA	NA	NA	NA	NA	NA
Silver	0.005	<0.005	<0.005	0.24	0.14	<0.01	<0.01
Sodium	NE	24.0	25.0	19.7	22.4	3.0	3.0
Strontium	NE	NA	NA	NA	NA	0.08	0.07
Sulfate	NE	30.0	28.0	NA	NA	NA	NA
Vanadium	NE	NA	NA	NA	NA	<0.005	<0.005
Zinc	1.0	0.1	0.7	30.0	17.0	0.24	0.06
PCB (ppb)	NE	0.9	4.4	22.0	28.0	1.0	<0.1
Aliphatic hydrocarbons (ppb)	NE	BDL	BDL	23,000	BDL	BDL	BDL

NE - Not established
NA - Not attempted
BDL - Below detection limit

	PCB level (in ppm)
Beans	0.06
Bean leaves	0.13
Corn	0.05
Okra	0.05

Although the Food and Drug Administration has assigned no action level for PCB's in plant matter, it is felt that these values are minute, and do not present any hazard to public health.

RStJ:tk

Summary, Conclusions, and Recommendations

This report is prepared to determine the hydrological framework and possible disposal sites in that part of Dead Creek which lies between New Queeny Avenue and Judith Lane. The potential disposal sites in the area, which have had an impact on ground water, soils, and plants, include: an open dump, a holding pond at Cerro Copper, a former disposal impoundment on the east side of the creek, a pond which exists in H. H. Hall's former sand pit, and 3 sand pits which are now filled.

Twelve monitoring wells drilled adjacent to Dead Creek, and 5 hand auger borings made in the creek, indicate that a 6 to 17 feet thick silt mantle overlies the Henry Formation sands, which are the major aquifer in the area. The creek, which has fill material in it now, at one time had scoured down into the Henry Formation sands. It is clear that soils and ground water in the immediate vicinity of Dead Creek are polluted and that further study is needed for more definitive answers. The ground water quality in the IEPA monitoring wells is probably a result of the above pollution sources combined. These wells show that ground water in the vicinity of the creek has been effected most, and that downgradient wells, some 400 feet away, show little contamination.

The findings and conclusions reached, based on this study, are listed below:

1) The surficial silt mantle is thin and has an average permeability of 5×10^{-6} cm/sec.

2) The Henry Formation sands are a major aquifer and have an average permeability of 4.4×10^{-3} cm/sec.

3) At one time the creek bottom reached, and the sand pits were excavated into the Henry Formation sands.

4) Chemical analysis of soils indicate that surficial soils are primarily polluted at the holding pond in Cerro Copper's plant and in Dead Creek itself.

5) Soil samples from the pond are high in inorganics and organics, including silver, nickel, lead, cadmium, arsenic, copper, manganese, PCB, aliphatic hydrocarbons, and dichlorobenzene.

6) Soil samples from the creek in the study area were high in organics and inorganics. In general, organics were high in the north end, and inorganics in the south end. PCB, dichlorobenzene, xylene, trichlorobenzene, chloronitrobenzene, biphenyl, dichlorophenol, alkylbenzenes, naphthalenes, hydrocarbons, cadmium, cobalt, iron, mercury, zinc, chromate, copper, and phosphorus were in high concentrations. Waste disposal in the creek is the main cause of higher levels of chemicals.

7) PCB and inorganics have migrated to some degree vertically into the Henry Formation sands from the creek bed.

8) When traveling westward, ground water carries away pollutants from the fill in the creek.

9) Surface water from the creek infiltrates downward and carries pollutants into ground water.

10) The holding ponds on Cerro Copper's property, the disposal impoundment, and the open dump are among the major pollution sources of ground water in the area.

11) There has been no tangible evidence to show that former sand pits in the area contribute to any ground water pollution. This does not mean that they don't.

12) Ground water near the creek is polluted. The pollutants include PCB, chlorophenol, chlorobenzene, dichlorobenzene, dichlorophenol, cyclohexanone, chloroaniline, copper, iron, manganese, phosphorus, and R.O.E.

13) Ground water pollution is somewhat reduced at monitoring wells located approximately 400 feet west of the creek.

14) Water from the pond in the Cerro Copper Plant is highly polluted with organics and inorganics.

15) With the present data available, it is difficult to determine the effect which the pond by Judith Lane has on the areas ground water.

Recommendations

1) Ground water pollution sources are many in the area, and further detailed study(ies) is necessary to determine their location, extent and impact on the ground water.

2) Ground water in the study area should not be used for human consumption.

3) Feasibility of removing all wastes and polluted soils from the former disposal impoundment, Cerro Copper's ponds, and the open dump should be studied. If not possible, these areas should have suitable cover material and monitor wells placed on them.

4) The fill material in the creek should be removed and the creek must be filled with a clayey soil later. If this is not possible, the present creek topography must be filled to the ground level with a clayey soil.

5) Taking the above recommendations into consideration, a plan might also be developed to install a system of monitor wells for ground water quality analysis in the area. This could aid local well drillers and public officials to insure public safety.

6) Plans for the construction of New Queeny Avenue should be secured to determine the depth of former sand pits in the area.

References

Becker, D. L. 1981. Thermal Infrared Survey of Hazardous Waste Sites East St. Louis, Illinois. United States Environmental Protection Agency, p.18.

Bergstrom, R. E., and T. R. Walker 1956. Groundwater Geology of the East St. Louis Area, Illinois. ISGS, Report of Investigations 191, p.44.

I. E. P. A. Files

Jones, D. M. A. 1966. Variability of Evapotranspiration in Illinois, ISWS, p.13.

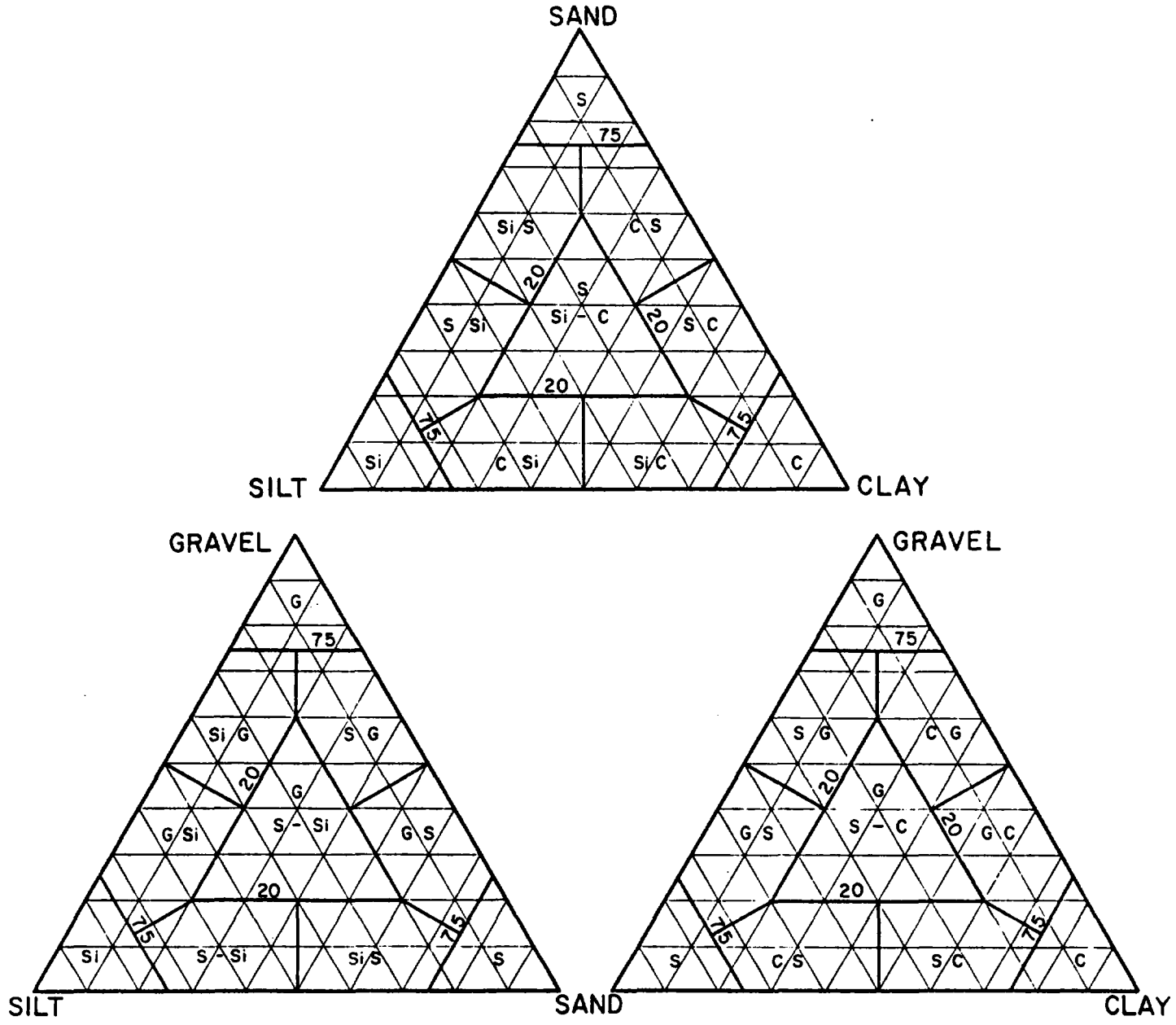
Pettijohn, F. J. 1975. Sedimentary Rocks. 3rd ed., N.Y., Harper and Row, p.628.

Schicht, R. J. 1965. Ground-Water Development in East St. Louis Area, Illinois. ISWS, p.70.

Personal Communications

Neuman, R. W. 1981, Assistant Attorney General, Illinois, personal communication (February).

Appendix 1 - Boring Logs



Percent grain size	Adjective modifiers for minor grain sizes*
not included in major classification	w/ some
< 5 %	trace

* Only applicable to wells bored by the IEPA

Figure A-1. Textural triangles (adopted from Shepard, 1954) and terminology used for classification of unconsolidated deposits.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/8/80 BORING NO. B-1 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO _____ WHICH Monitor (G-101)

TYPE AND LENGTH OF CASING PVC 29.5 FT. CASING 1.0 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 371.32 to 391.32 (20 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cutting

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 390.32

AFTER 2 DAYS 393.92

AFTER 14 DAYS 393.22

ELEVATION	#	*	N	WELL DESIGN
+3				
GROUND SURFACE 399.82 0				
Clayey Silt (topsoil) Dark brown to gray	1	M		
organics		D		
-5				
	2	M		
392.15				
Silt Brown micaceous	3	W		
389.82 -10				
Sand (arenitic) Tan very fine grained, moderately sorted, rounded, containing ferro-magnesian minerals.	4	W		
	5	W		
384.82 -15				

ELEVATION	#	*	N	WELL DESIGN
		W		
Sand (arkosic) Tan fine to coarse grained, moderately rounded, containing ferro-magnesian minerals				
-20				
very poorly sorted	6	W		
-25				
w/some rounded medium grained gravel	7	W		
-30				
367.82		W		
Boring completed				

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

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LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/8/80 BORING NO. B-2 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO _____ WHICH Monitor (G-102)

TYPE AND LENGTH OF CASING PVC 34.0 FT CASING 1.2 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 375.59 to 400.59 (25 feet slotted)

ANNULUS FILL MATERIAL
ABOVE PACKING Cuttings
PACKING Bentonite
SCREEN 3/8" Gravel

GROUND WATER EL.
AT COMPLETION 393.39
AFTER 2 DAYS 394.09
AFTER 14 DAYS 393.89

ELEVATION	#	*	N	WELL DESIGN	ELEVATION	#	*	N
+3						7	W	4/6
						8	W	4/8
GROUND SURFACE 408.39 0								
					-20			
	1	D	3' Spn.			9	W	5/6
	2	D	5/5					
-5					-25			
	3	D	6/6					
						10	W	5/3
	4	D	4/5					
-10								
	5	M	2/2		-30			
395.39								5/4
	6	M	5/5					
▼ -15								

Clayey Silt
Tan to brown
organics

Silt
Light tan
micaceous throughout

Sandy Silt
Light gray

Gray
organics

Sand (arkosic)
Gray
fine grained, moderately sorted

Sand (arkosic)
Tan
fine grained, moderately sorted

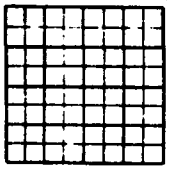
Gray
coarse grained, poorly sorted lenses

fine to medium grained

coal & wood chips throughout

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data
N - Blow Count
PR - Partial Recovery
NR - No Recovery



LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair County
Dead Creek/Cahokia
B-2 (G-102)

ELEVATION	#	•	N	WELL DESIGN
-35				
		NR	17/14	
-40				
-45				
-50				
-55				
-60				

Sand (arkosic)
Gray
fine to medium grained,
poorly sorted, contains
coal & wood chips
throughout

371.89

Boring completed

ELEVATION	#	•	N	WELL DESIGN
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St.Clair SITE NO. PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/9/80 BORING NO. B-3 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO WHICH Monitor (G-103)

TYPE AND LENGTH OF CASING PVC 35.5 FT CASING 2.7 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 375.30 to 401.90 (26.6 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 393.10

AFTER 1 DAYS 394.1

AFTER 13 DAYS 394.4

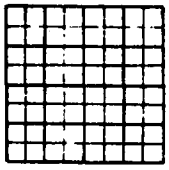
ELEVATION	#	*	N	WELL DESIGN	
+3					
GROUND SURFACE 408.10 0					
	1	D			Clayey Silt (topsoil) Brown w/some sand
		D	4/4		Silt Light tan micaceous
-5					
	2	D	5/4		Clayey Silt w/some sand oxidation
	3	D	2/2		Sandy Silt Tan to gray w/some clay micaceous throughout
-10					
396.85	4	M	2/2		Clayey Silt Gray
	5	W	4/5		Sand (arkosic) Tan very fine grained
▼ -15					

ELEVATION	#	*	N	WELL DESIGN	
	6	W	5/7		Sand (arkosic) w/some silt Tan fine grained
-20					
	7	W	6/9		w/some silt
-25					
	8	W	5/7		fine to medium grained, moderately sorted, subrounded
-30					
	9/10	W	9/17		w/some gravel fine to coarse grained, poorly sorted w/black petroleum smelling substance

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery



LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair
Dead Creek/Cahokia
B-3 (G-103)

ELEVATION	#	*	N	WELL DESIGN
-35				
	11	W	8/15	
-40				
-45				
-50				
-55				
-60				
-65				
-70				
-75				
-80				
-85				
-90				

Sand (arkosic)
Tan
medium to coarse grained,
poorly sorted, subangular
w/wood chips & peculiar
smell

371.60

Boring complete

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Ken Bosie

DATE 10/9/80 BORING NO. B-4 HELPER Ron St. John

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO _____ WHICH Monitor (G-104)

TYPE AND LENGTH OF CASING PVC . 37.4 FT CASING 3.4 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 375.3 to 400.3 (25 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 392.80

AFTER 1 DAYS 393.4

AFTER 14 DAYS 393.6

ELEVATION	#	*	N	WELL DESIGN
+3				
GROUND SURFACE 409.30 0				
Silty Sand (topsoil) Light tan w/some clay throughout	1	D		
Sandy Silt micaceous	2	D	3/5	
-5				
2" clay lense				
402.30	3	M	4/5	
Silty Sand Light tan micaceous Brown & gray	4	M	4/5	
397.30				
-10				
Sand (arkosic) Tan fine to medium grained	5	M	5/4	
394.80				
Clay Gray oxidation	6	W	5/4	
-15				

ELEVATION	#	*	N	WELL DESIGN
Clay Gray oxidation	7	W	2/6	
392.80				
Sand (arkosic) Tan to brown fine to medium grained	8	W	8/8	
-20		W	3/5	
-25				
	9	W	5/8	
-30				
fine to coarse grained, poorly sorted, subrounded w/gravel	10	W	8/9	

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

52

LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair County
Dead Creek/Cahokia
B-4 (G-104)

ELEVATION	#	*	N	WELL DESIGN

Sand
Tan & brown
fine to coarse
grained, poorly
sorted, subrounded
w/occasional gravel

372.80

Boring complete

-35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/10/80 BORING NO. B-5 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO _____ WHICH Monitor (G-105)

TYPE AND LENGTH OF CASING PVC 37.1 FT. CASING 2.6 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 372.81 to 397.81 (25 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 392.31

AFTER 6 DAYS 394.61

AFTER 13 DAYS 394.51

ELEVATION	#	*	N	WELL DESIGN
+3				
GROUND SURFACE 407.31 0				
	1	D	3' Spn.	
	2	D	4/4	
-5				
		D	4/3	
	3	M	2/2	
-10				
	4	M	2/1	
	5	M	3/1	
▼ -15				

Silt (topsoil)
Brown

Tan

Brown
organics

Brown to gray
intermittent sand,
silt & clay
micaceous & oxidation
throughout

Silty Sand

Gray to brown
2" clay lense @ 13 ft.

ELEVATION	#	*	N	WELL DESIGN
	6	W	4/4	
	7		5/7	
390.31				
-20				
	8		5/5	
-25				
	9		7/6	
-30				
	10		5/5	

Sand
Brown
very fine grained
micaceous

Sand (arkosic)
Gray
micaceous

Brown

Tan
fine to medium grained
gravel throughout

medium grained
w/gravel

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data
N - Blow Count
PR - Partial Recovery
NR - No Recovery

54

LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair County
Dead Creek/Cahokia
B-5 (G-105)

ELEVATION	#	*	N	WELL DESIGN
-35				
	11	W	5/6	
370.81				
-40				
-45				
-50				
-55				
-60				
-65				
-70				
-75				
-80				
-85				
-90				

Sand & Gravel (arkosic)
Gray
medium grained
sand & fine
grained gravel

Boring complete

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/15/80 BORING NO. B-6 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO _____ WHICH Monitor (G-106)

TYPE AND LENGTH OF CASING PVC 42.4 FT. CASING 2.4 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 366.67 to 401.67 (35 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 390.67

AFTER 1 DAYS 394.07

AFTER 7 DAYS 394.17

ELEVATION	#	*	N	WELL DESIGN
+3				
GROUND SURFACE 406.67 0				
Gravel & asphalt Brown to black w/silty topsoil throughout		D	3' Spn.	
		D	2/3	
402.17				
-5				
Silt Light tan micaceous		D	3/2	
Tan to black (strong chemical odor)	1	M	3/2	
-10				
Gray to black	2	M	2/1	
395.17				
Silty Sand Gray to black (chemical odor)	3	M	5/5	
-15				

ELEVATION	#	*	N	WELL DESIGN
Sand Black (strong chemical color & odor)	4	W	1/6	
	5	W	5/6	
387.17				
-20				
Sand (arkosic) Gray fine to medium grained subangular, poorly sorted, chemical odor	6	W	3/2	
			2/3	
-25				
-30				
chemical colored hues	7	W	5/11	

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair County
Dead Creek/Cahokia
B-6 (G-106)

ELEVATION	#	*	N	WELL DESIGN
-35				
Sand & Gravel Gray coarse grained w/wood & coal fragments throughout			8 10	
-40		NR		
365.17				
Boring complete				
-45				
-50				
-55				
-60				
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/16/80 BORING NO. B-7 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO _____ WHICH Monitor (G-107)

TYPE AND LENGTH OF CASING PVC 35.1 FT CASING 1.3 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 367.05 to 397.05

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 391.35

AFTER 6 DAYS 390.05

AFTER 15 DAYS 393.65

ELEVATION	#	*	N	WELL DESIGN	ELEVATION	#	*	N	WELL DESIGN
+3									
GROUND SURFACE 400.85 0									
Silt (topsoil) Brown	1	D							
		D	6/7						
Brown to light tan micaceous throughout intermittent clay, silt & sand -5									
	2	M	3/3						
Silty Sand Tan oxidation	3	M	3/3						
391.35 ▼ -10									
Sand (arkosic) Tan fine grained (containing chemical hues)	4	W	3/3						
-15									
					Sand (arkosic) Gray to black fine grained micaceous (observably polluted)	5	W	3/5	
						6	W	6/8	
					-20				
					Gray fine to medium grained	7	W	6/9	
					-25				
						8	W	5/10	
					-30				
						9	W	7/8	

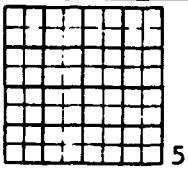
All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data

N - Blow Count

PR - Partial Recovery

NR - No Recovery



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LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

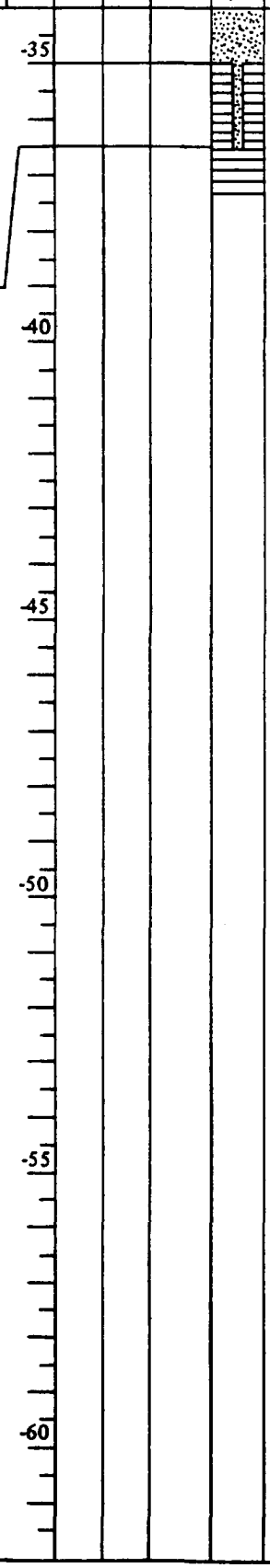
St.Clair County
Dead Creek/Cahokia
B-7 (G-107)

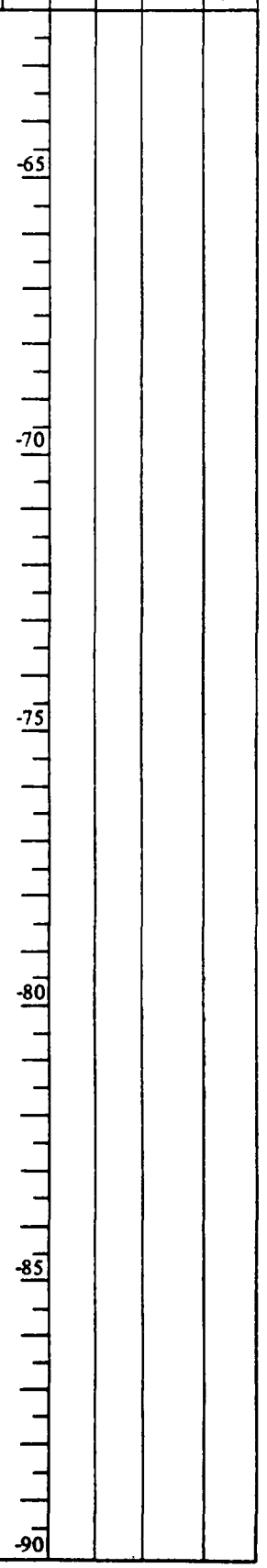
ELEVATION	#	•	N	WELL DESIGN

Sand (arkosic)
Gray
fine to medium
grained, subangular
w/gravel

364.35

Boring complete





ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St.Clair SITE NO. PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/20/80 BORING NO. B-8 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO WHICH Monitor (G-108)

TYPE AND LENGTH OF CASING PVC 36.4 FT CASING 2.2 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 372.56 to 402.56

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 394.76

AFTER 3 DAYS 395.06

AFTER 11 DAYS 394.16

ELEVATION	#	*	N	WELL DESIGN	ELEVATION	#	*	N	WELL DESIGN

+3

GROUND SURFACE 406.76 0

Silty Clay (topsoil)
Brown — 1 D

Silty Sand
Tan
micaceous
w/some clay throughout — 2 D 4/4

-5

Sandy Silt
400.76 — 3 M 5/7

Sand (arkosic)
Tan
fine grained — 4 M 4/4

-10

fine to medium grained
(polluted smell) — 5 M 5/4

augered through to
35 feet — 6 W 6/5

-15

augered through to 35 feet, cuttings indicated sand coarsening with depth

-20

-25

-30

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data
N - Blow Count
PR - Partial Recovery
NR - No Recovery

60

LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair County
Dead Creek/Cahokia
B-8 (G-108)

ELEVATION	#	•	N	WELL DESIGN

augered through to 35 feet

371.76

Boring complete

-35 -40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/21/80 BORING NO. B-9 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO WHICH Monitor (G-109)

TYPE AND LENGTH OF CASING PVC 38.5 FT CASING 3.5 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 370.68 to 397.68 (27 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 392.18

AFTER 2 DAYS 394.38

AFTER 10 DAYS 394.98

ELEVATION	#	*	N	WELL DESIGN	ELEVATION	#	*	N	WELL DESIGN
+3									
GROUND SURFACE 407.18 0					Sand (sludge) Black 2" metallic zone	7a 7b	W	11/9	
Silt (topsoil) Brown to light tan	1	D				8 PCE	W	5/6	
					-20	9	W	10/10	
Light tan micaceous & oxidation	2	D	5/4			10	W	8/10	
-5						11	W	4/7	
	3	D	6/4		-25				
					fine to medium grained w/gravel	12	W	6/7	
Clayey Silt Tan to gray micaceous 398.68	4	D	4/6						
Sand Gray very fine grained (chemical smell) -10	5	M	12/9		-30	13	W	4/9	
395.18									
Sand (arkosic) Gray very fine grained (strong chemical odor)	6	M	11/14						
▼ -15									

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

62

LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair County
Dead Creek/Cahokia
B-9 (G-109)

ELEVATION	#	*	N	WELL DESIGN
-35				
		NR	8/13	
-40				
-45				
-50				
-55				
-60				
-65				
-70				
-75				
-80				
-85				
-90				

Sand
Black
fine to coarse
grained w/fine
grained gravel
(polluted)

370.68

Boring complete

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/22/80 BORING NO. B-10 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO _____ WHICH Monitor (G-110)

TYPE AND LENGTH OF CASING PVC 31.3 FT CASING 1.3 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 377.14 to 402.14 (25 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cutting

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL

AT COMPLETION 395.14

AFTER 1 DAYS 394.74

AFTER 9 DAYS 394.34

	ELEVATION	#	*	N	WELL DESIGN
GROUND SURFACE 407.14	+3 / 0				
Sandy Silt (topsoil) Brown to light tan		1	D		
Tan w/gravel throughout (disturbed) 403.14		2	D	3/2	
	-5				
Sandy Silt Brown to gray micaceous		3	D	4/3	
Tan to gray intermittent clayey, sand & silt		4	M	2/2	
	-10				
		5	M	5/5	
Gray to tan oxidation 395.14 ▼					
Silty Sand (arkosic) Tan fine grained micaceous 392.14	-15	6	W	8/6	
Sand (arkosic) Tan fine grained		7	W	4/6	
		8	W	5/4	
	-20				
		9	W	5/4	
Gray fine to medium grained					
		10	W	2/8	
	-25				
	-30				
Gray to tan		11	W	4/6	
medium to coarse grained 375.64					
Boring complete					

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data

N - Blow Count

PR - Partial Recovery

NR - No Recovery

64

LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/23/80 BORING NO. B-11 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO _____ WHICH Monitor (G-111)

TYPE AND LENGTH OF CASING PVC 35.5 FT. CASING 1.5 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 374.41 to 396.41 (22 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 391.91

AFTER 7 DAYS 394.21

AFTER 8 DAYS 393.91

	ELEVATION	#	*	N	WELL DESIGN
GROUND SURFACE 408.41	+3 / 0				
Sandy Silt (topsoil) Brown to tan micaceous throughout		1	D		
Light tan		2	D	4/4	
	-5	3	D	4/4	
Light tan to gray clay lenses		4	D	3/3	
	-10				
Gray to tan intermittent clay, silt & sand		5	M	3/3	
		6	M	3/1	
	-15				

	ELEVATION	#	*	N	WELL DESIGN
Clayey Silt Gray micaceous		7	W	1/1	
391.91 ▼					
		8	W	3/4	
Sand (arkosic) Tan fine grained micaceous	-20				
		9	W	4/4	
	-25				
fine to medium grained w/fine grained gravel		10	W	5/5	
Sand & Gravel (arkosic) Tan fine to coarse grained subangular to angular	-30	11	W	7/11	

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

65

LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair County
Dead Creek/Cahokia
B-11 (G-111)

ELEVATION	#	*	N	WELL DESIGN
-35				
	12	W	12/14	
-40				
-45				
-50				
-55				
-60				

Sand & Gravel (arkosic)
Tan
medium to coarse grained sand & fine to coarse grained gravel

371.91

Boring complete

ELEVATION	#	*	N	WELL DESIGN
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/29/80 BORING NO. B-12 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO WHICH Monitor (G-112)

TYPE AND LENGTH OF CASING PVC . 37.8 FT CASING 2.7 FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 372.62 to 394.62 (22 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cutting

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 396.72

AFTER 12 DAYS 394.12

AFTER DAYS

ELEVATION	#	*	N	WELL DESIGN
+3				
GROUND SURFACE 407.72 0				
Fill Black asphaltic (disturbed)				
-5				
	1	M		
400.72				
Clay w/Silt Gray poorly indurated organics	2	M	5/5	
-10				
396.47 ▼	3	M	2/4	
Silt Gray micaceous				
	4	W	2/2	
-15				

ELEVATION	#	*	N	WELL DESIGN
Silt Gray micaceous	5	W	2/7	
390.72				
	6	W	5/4	
Sand (arkosic) Gray fine grained w/silt throughout				
-20				
Tan	7	W	4/5	
-25				
Gray fine to medium grained	8	W	6/7	
-30				
fine to coarse grained	9	W	10/13	

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

LPC-34 3/79

BORING LOG

SH. 2 of 2 SH.

St. Clair County
Dead Creek/Cahokia
B-12 (G-112)

ELEVATION	#	*	N	WELL DESIGN
-35	10	W	16/22	

Sand & Gravel (arkosic)
Gray
fine to coarse
grained

371.22

Boring complete

-40 -45 -50 -55 -60 -65 -70 -75 -80 -85 -90

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO. P-1 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES _____ NO X WHICH _____

TYPE AND LENGTH OF CASING _____ . _____ FT CASING _____ FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS _____

ANNULUS FILL MATERIAL ABOVE PACKING _____ PACKING _____ SCREEN _____	ELEVATION	#	*	N	WELL DESIGN	GROUND WATER EL. AT COMPLETION _____ AFTER _____ DAYS _____ AFTER _____ DAYS _____	ELEVATION	#	*	N	WELL DESIGN
	+3						-20				
GROUND SURFACE 401.03	0										
Silt Discolored chemical odor 400.03		1									
		2									
Clayey Silt Black chemical odor (strong @ 2 feet)		3									
		4									
398.03	-5	5					-25				
Silt Gray (wore mask)		6									
395.03		7									
Clayey Sandy Silt Gray		8									
393.03			NR								
Sand	-10										
392.03							-30				
Boring complete											
	-15										

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO. P-2 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES _____ NO X WHICH _____

TYPE AND LENGTH OF CASING _____, _____ FT. CASING _____ FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS _____

ANNULUS FILL MATERIAL ABOVE PACKING _____ PACKING _____ SCREEN _____	ELEVATION	#	*	N	WELL DESIGN	GROUND WATER EL. AT COMPLETION _____ AFTER _____ DAYS _____ AFTER _____ DAYS _____	ELEVATION	#	*	N	WELL DESIGN
	+3										
GROUND SURFACE 399.70	0										
Clayey Silt Gray							-20				
	-5										
391.70							-25				
Sand (arkosic) Tan fine grained											
390.70											
Boring complete	-10						-30				
	-15										

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

70

LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO. P-3 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES _____ NO X WHICH _____

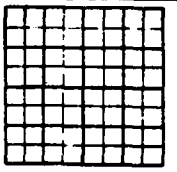
TYPE AND LENGTH OF CASING _____. _____ FT CASING _____ FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS _____

ANNULUS FILL MATERIAL ABOVE PACKING _____ PACKING _____ SCREEN _____	ELEVATION	#	*	N	WELL DESIGN	GROUND WATER EL. AT COMPLETION _____ AFTER _____ DAYS _____ AFTER _____ DAYS _____	ELEVATION	#	*	N	WELL DESIGN
	+3										
GROUND SURFACE 400.67	0										
Silt Black, orange & green 399.67		1					-20				
		2									
Clayey Silt Gray chemical odor 395.67		3									
		4									
Silt Gray micaceous 394.67	-5	5									
		6					-25				
Clayey Silt Gray micaceous 393.17		7									
		8									
Sand (arkosic) Gray fine grained 392.67	-10										
Boring complete							-30				
	-15										

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data
N - Blow Count
PR - Partial Recovery
NR - No Recovery



LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO. P-4 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES _____ NO X WHICH _____

TYPE AND LENGTH OF CASING _____ . _____ FT CASING _____ FT. ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS _____

ANNULUS FILL MATERIAL ABOVE PACKING _____ PACKING _____ SCREEN _____	ELEVATION	#	*	N	WELL DESIGN	GROUND WATER EL. AT COMPLETION _____ AFTER _____ DAYS _____ AFTER _____ DAYS _____	ELEVATION	#	*	N	WELL DESIGN
GROUND SURFACE 399.72	+3										
	0										
Sandy, Clayey, Silt Discolored		1									
398.72											
Clayey Silt Gray to black oxidation		2					-20				
397.72		3									
Silty Clay Gray oxidation		4									
396.72	-5	5									
Clayey Silt Gray oxidation		6					-25				
395.72		7									
Clayey, Sandy, Silt Gray		8									
393.72											
Silty Clay Gray	-10										
392.72							-30				
Sand (arkosic) Gray fine grained											
391.22											
Boring complete											
	-15										

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

72

LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. _____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO. P-5 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES _____ NO X WHICH _____

TYPE AND LENGTH OF CASING _____, _____ FT CASING _____ FT. ABOVE GROUND LEVEL

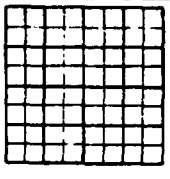
SCREENED INTERVAL ELEVATIONS _____

ANNULUS FILL MATERIAL ABOVE PACKING _____ PACKING _____ SCREEN _____	ELEVATION	#	*	N	WELL DESIGN	GROUND WATER EL. AT COMPLETION _____ AFTER _____ DAYS _____ AFTER _____ DAYS _____	ELEVATION	#	*	N	WELL DESIGN
GROUND SURFACE 399.65	+3 0						-20				
Silt Orange, black & gray 398.65		1									
Clayey Silt Gray oxidation 397.65		2 3									
Silty Clay Gray organics & oxidation 396.65	▼ -5	4 5					-25				
Silt Gray micaceous & clay lenses 394.65		6 7									
Clayey Silt Gray to black 393.65		8 9									
Silt Gray to black micaceous 389.85	-10						-30				
Sand (arkosic) Gray fine grained 389.65											
Boring complete	-15										

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery



LPC-34 3/79

Appendix 2 - Grain Size and Permeability Analysis

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24219

Date Collected 10/9/80 Date Received Nov.14.1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-1,0-2.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
_ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
_ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

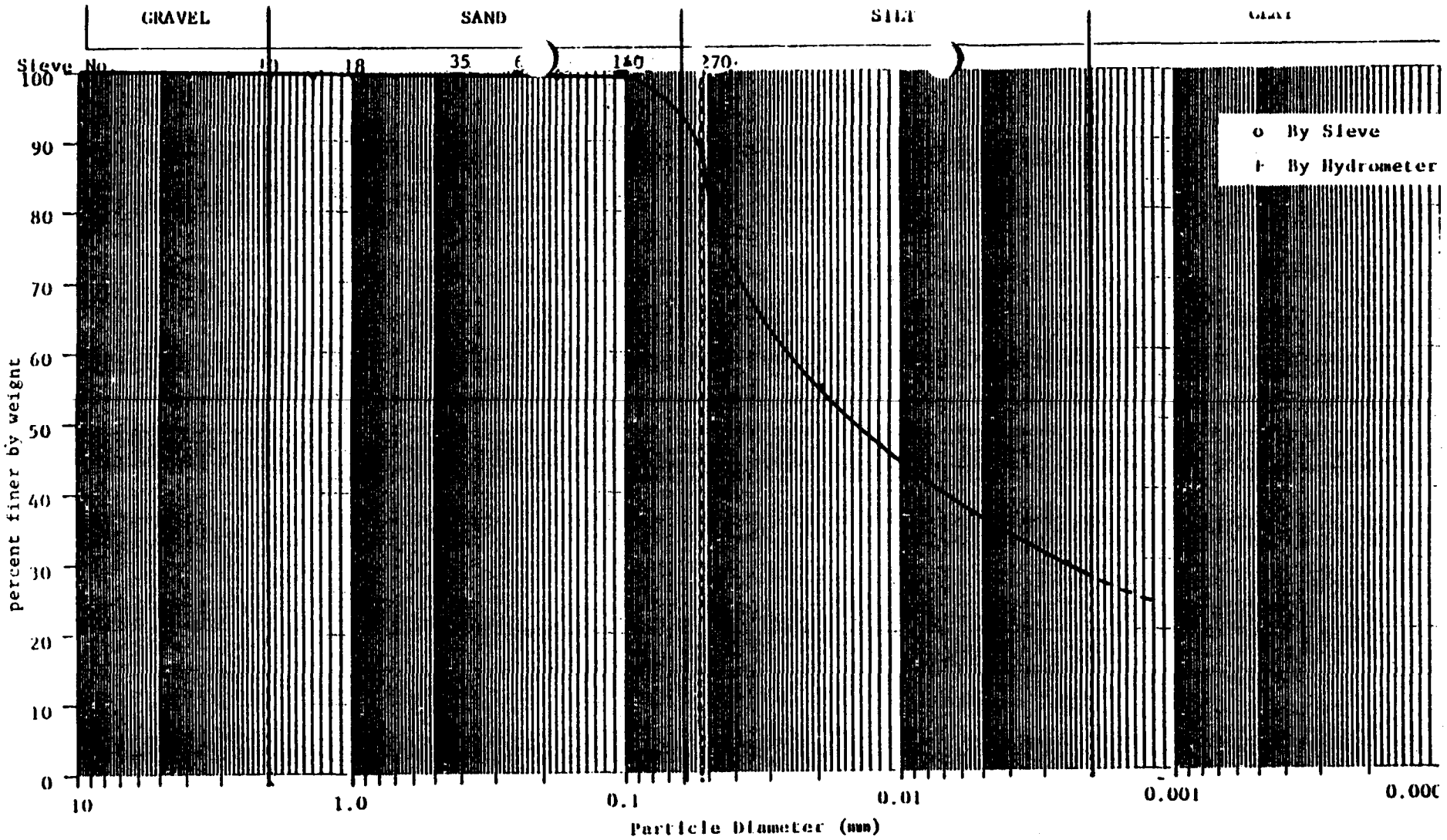
permeablilty:

4.5×10^{-6} cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.96	5.0	.0182	55.00
18	1.00	99.90	20.0	.0098	43.41
35	.417	99.84	60.0	.0055	37.63
60	.250	99.59	240.	.0025	29.91
140	.105	98.49	360.	.0022	28.95
270	.053	87.38			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel .04 % Sand 7.0 % Silt 64.03 % Clay 28.95 Name: Clayey Silt, w/some sand

✓-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24220

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-2, 5.0-6.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

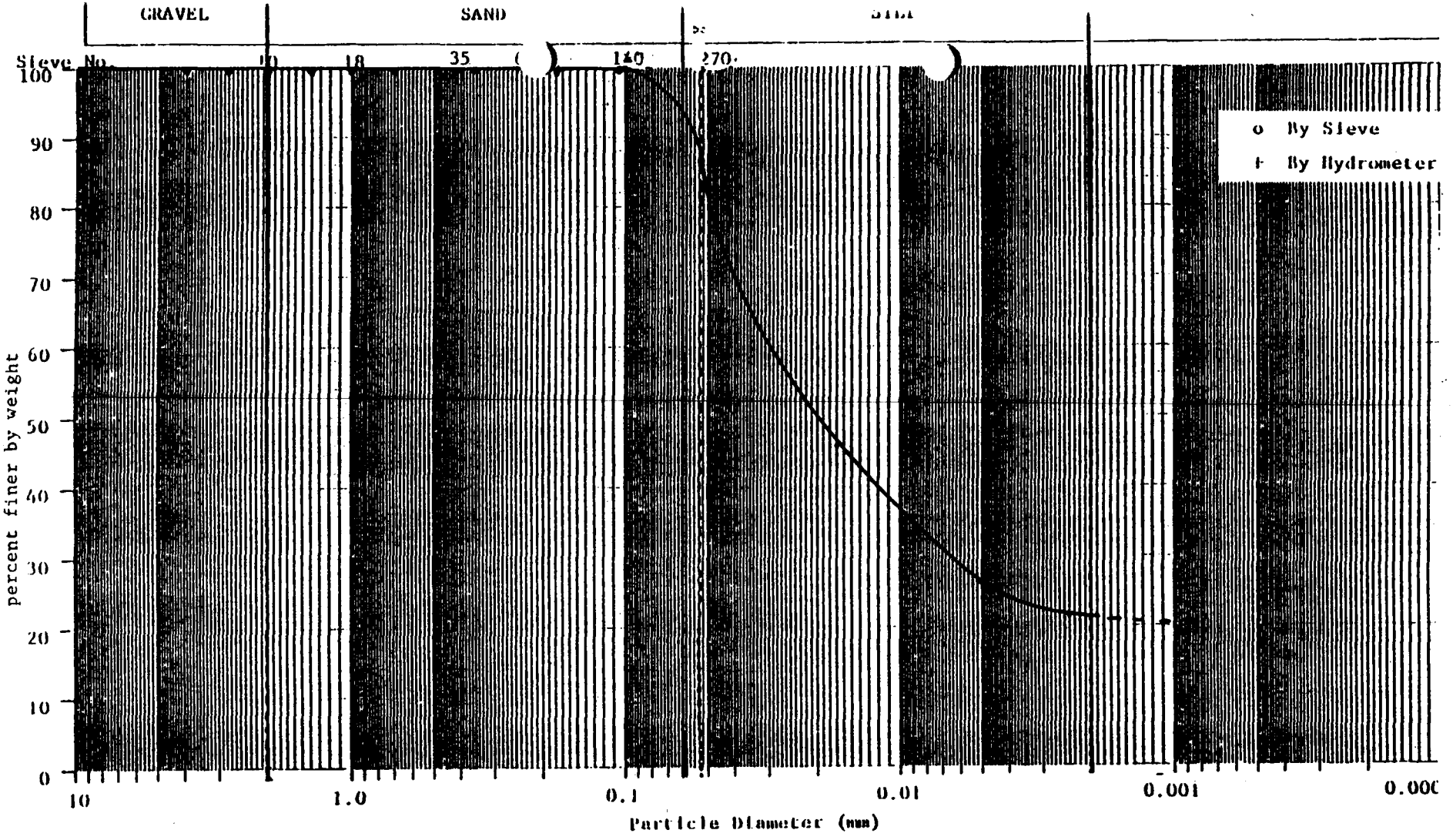
TEST RESULTS

permeablilty: 9.8×10^{-6} cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0170	45.30
18	1.00	99.98	20.0	.0092	36.00
35	.417	99.89	60.0	.0051	26.71
60	.250	99.80	240.	.0024	22.07
140	.105	99.31	360.	.0019	22.07
270	.053	87.02			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0 % Sand 7.0 % Silt 70.93 % Clay 22.07 Name: Clayey Silt, w/some sand

✓-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24221

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-3, 7.5-9.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

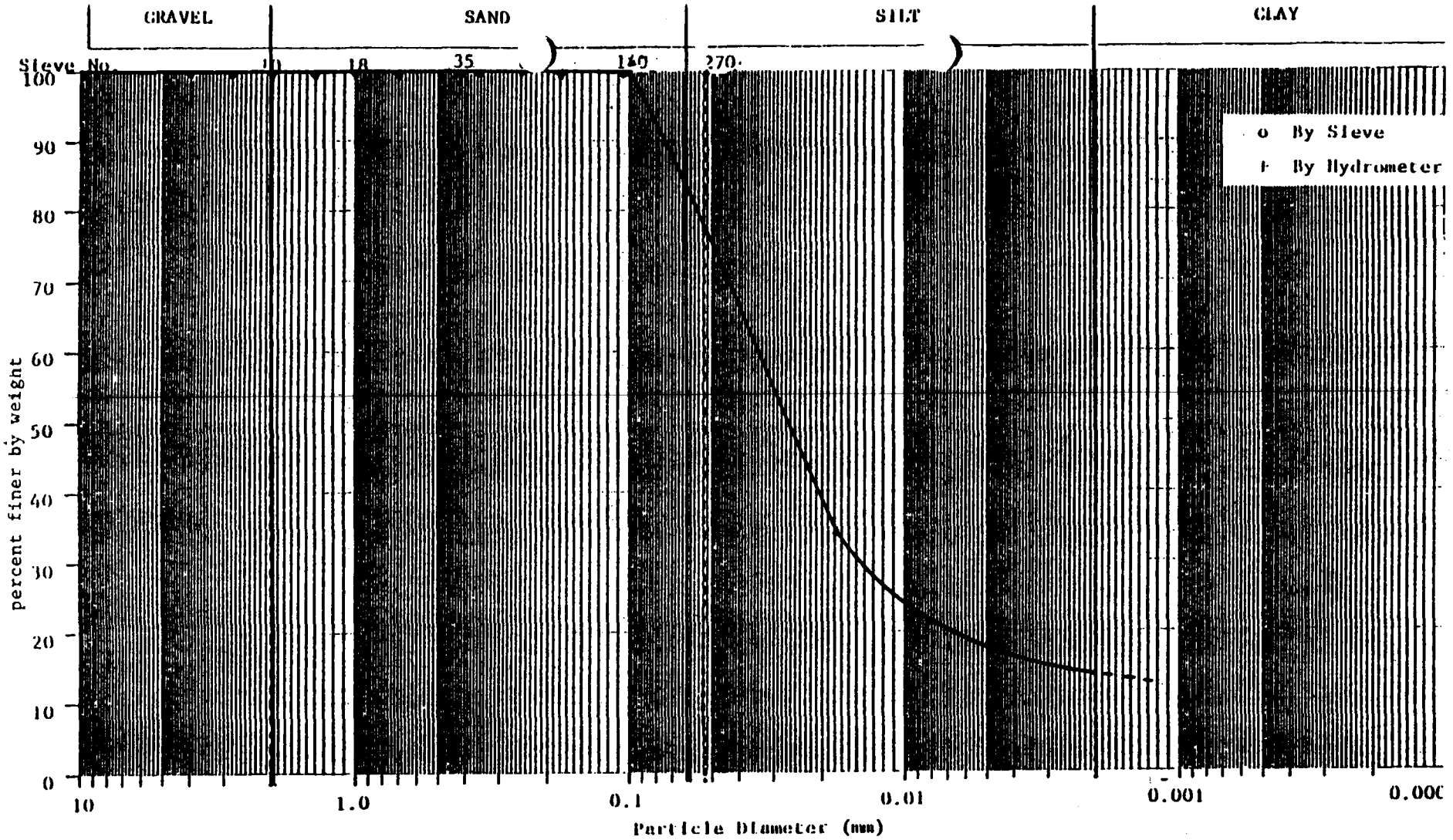
TEST RESULTS

permeablilty: 5.4×10^{-3} cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0186	34.49
18	1.00	100.00	20.0	.0088	22.32
35	.417	99.94	60.0	.0050	18.26
60	.250	99.89	240.	.0025	16.13
140	.105	99.11	360.	.0020	15.21
270	.053	77.74			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0 % Sand 18 % Silt 66.79 % Clay 15.21 Name: Sandy Silt w/some clay

✓-7&(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24222

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

B-3, S-4, 10.0-11.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

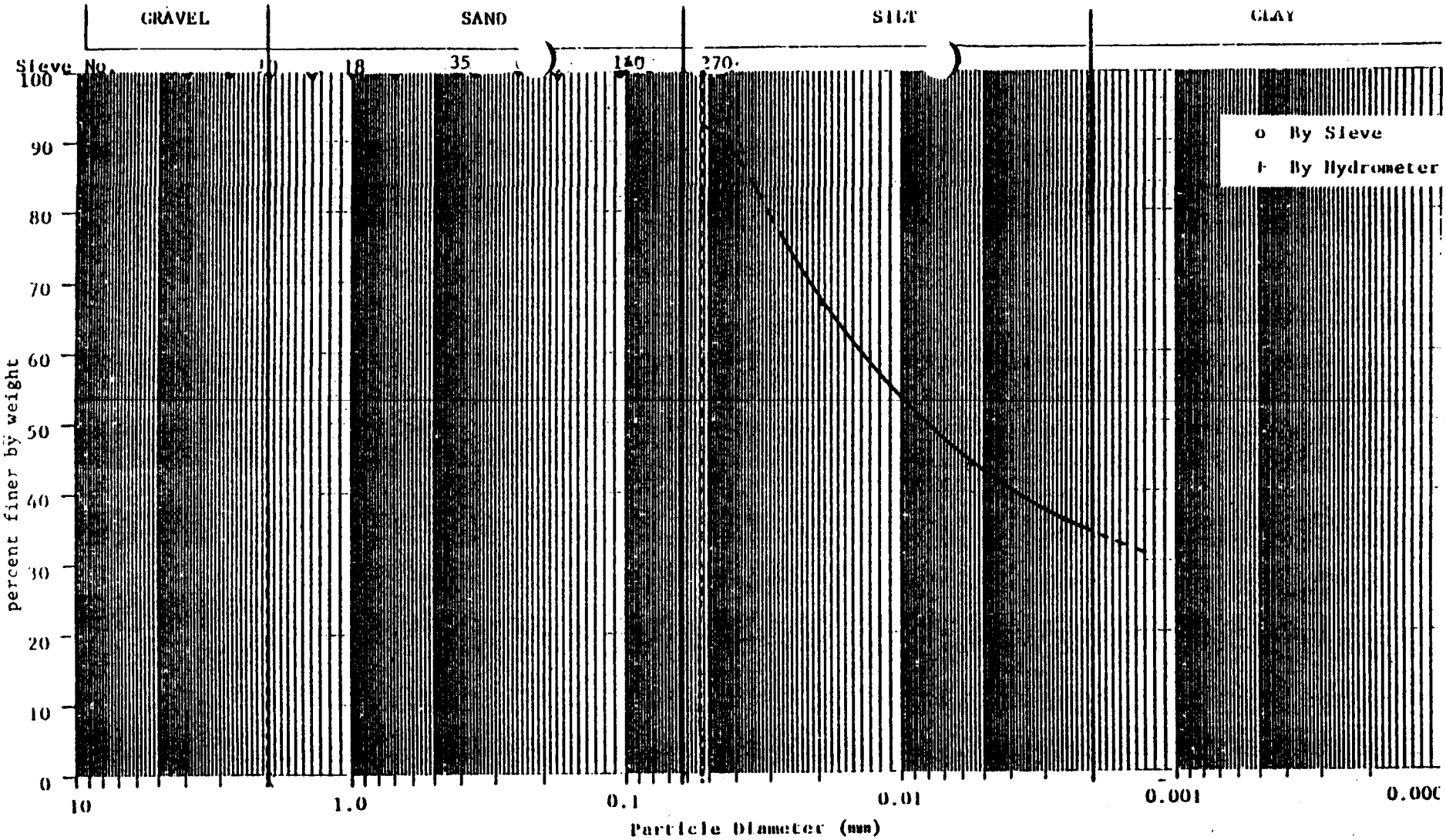
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0193	66.71
18	1.00	Less than 15%	20.0	.0098	52.01
35	.417	of sample	60.0	.0055	44.10
60	.250	larger than	240.	.0025	37.31
140	.105	.053 mm.	360.	.0022	35.05
270	.053				
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel & Sand less than 15% % Silt 49.95 or more % Clay 35.05 Name: Clayey Silt

V-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24223

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) B-3, S-5, 12.5-14.0		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

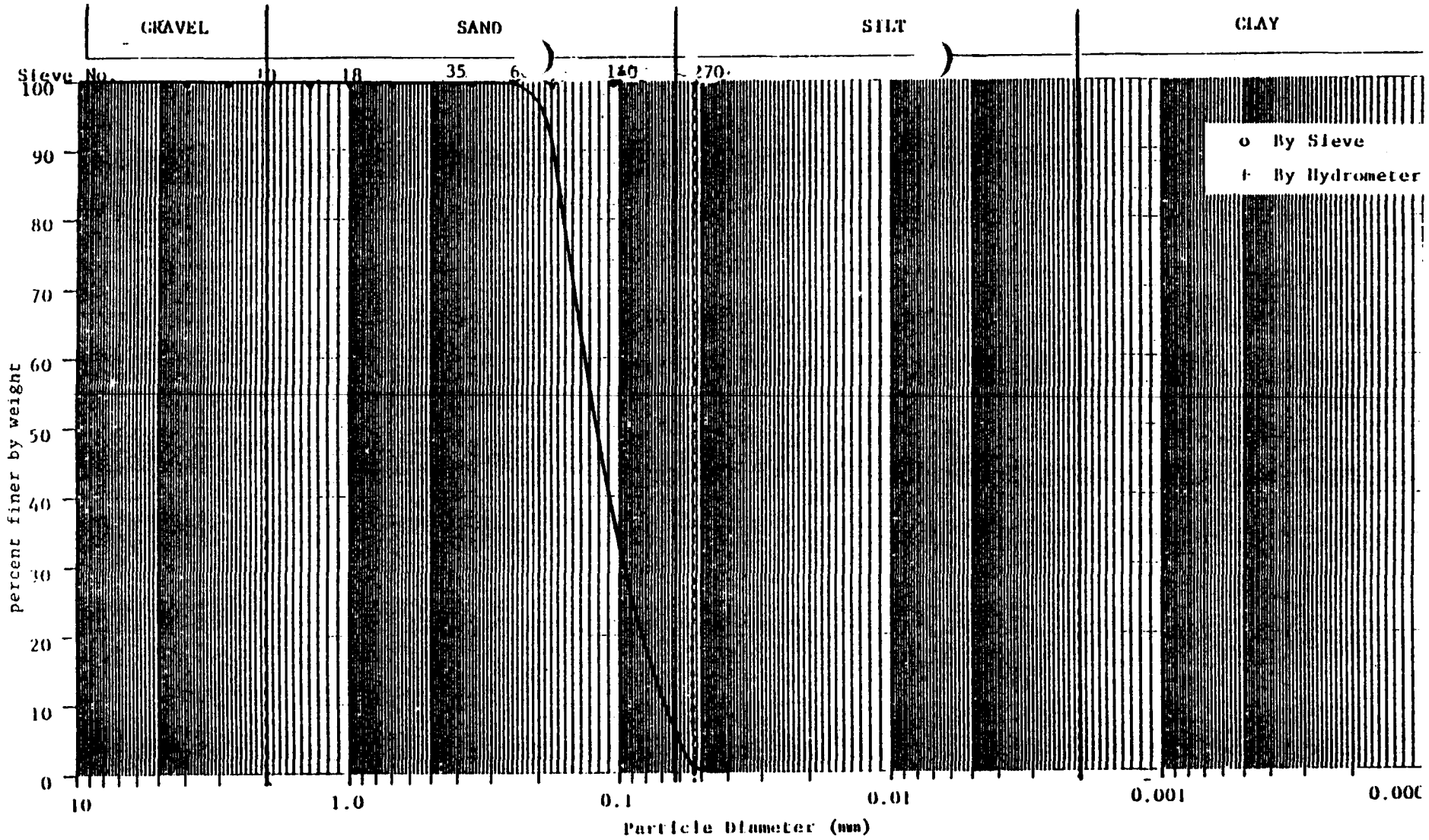
permeablility:

3.77×10^{-3} cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	NA	
18	1.00	100.00	20.0	Less than 15%	of the sample
35	.417	99.98	60.0	is finder than	.053 mm.
60	.250	99.93	240.		
140	.105	33.87	360.		
270	.053	1.17			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0 % Sand 95.0 % Silt & Clay 5% Name: Sand

✓-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24224

Date Collected 10/9/80 Date **Received** Nov.14, 1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-6, 15.0-16.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

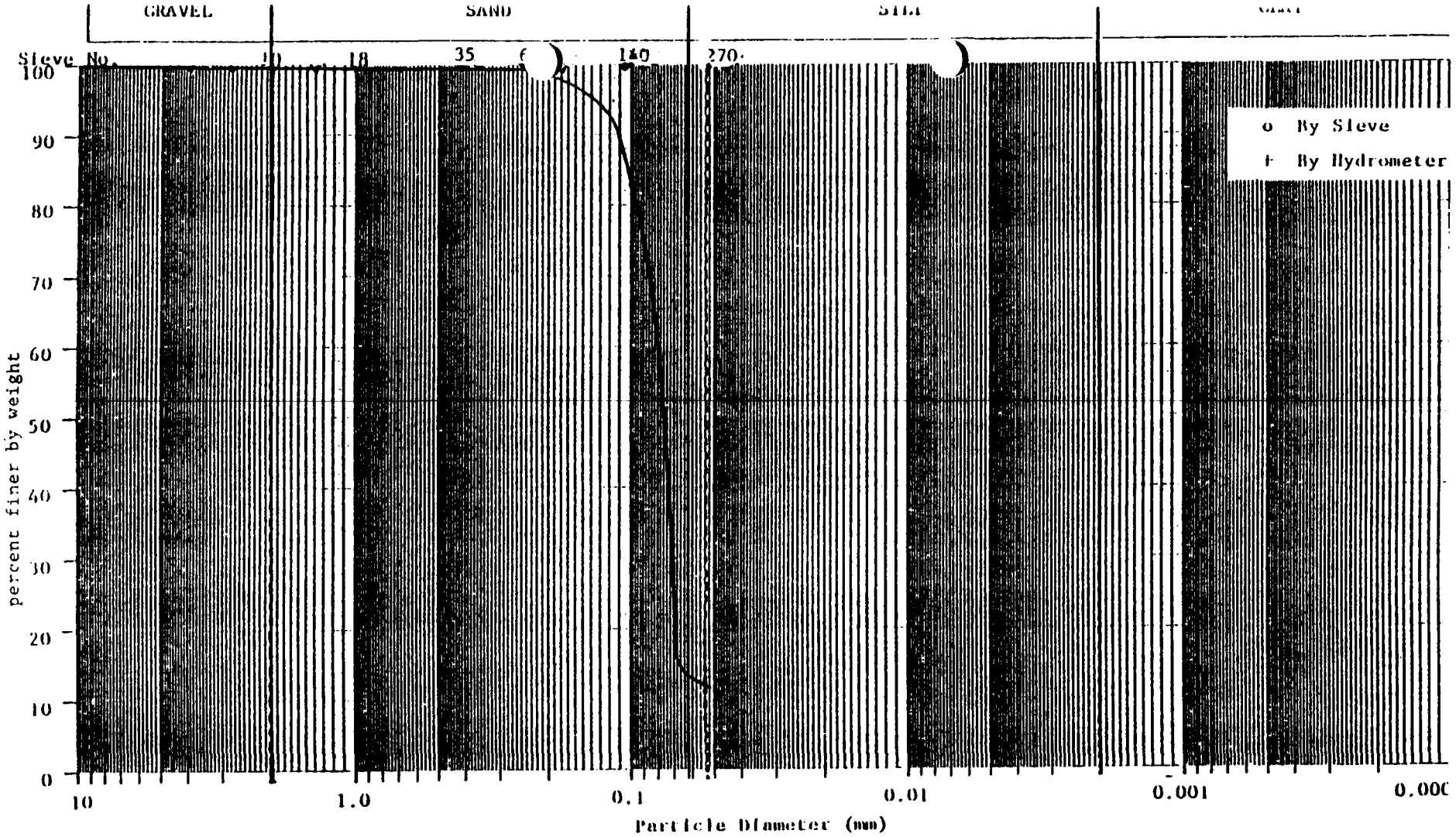
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.99	5.0	NA	
18	1.00	99.98	20.0	Less than 15%	of
35	.417	99.97	60.0	sample finer	than
60	.250	99.90	240.	.053 mm.	
140	.105	83.37	360.		
270	.053	10.90			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel 0 % Sand 89 % Silt 11 % Clay 0 Name: Sand w/some silt

✓-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24225

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-7, 20.0-21.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

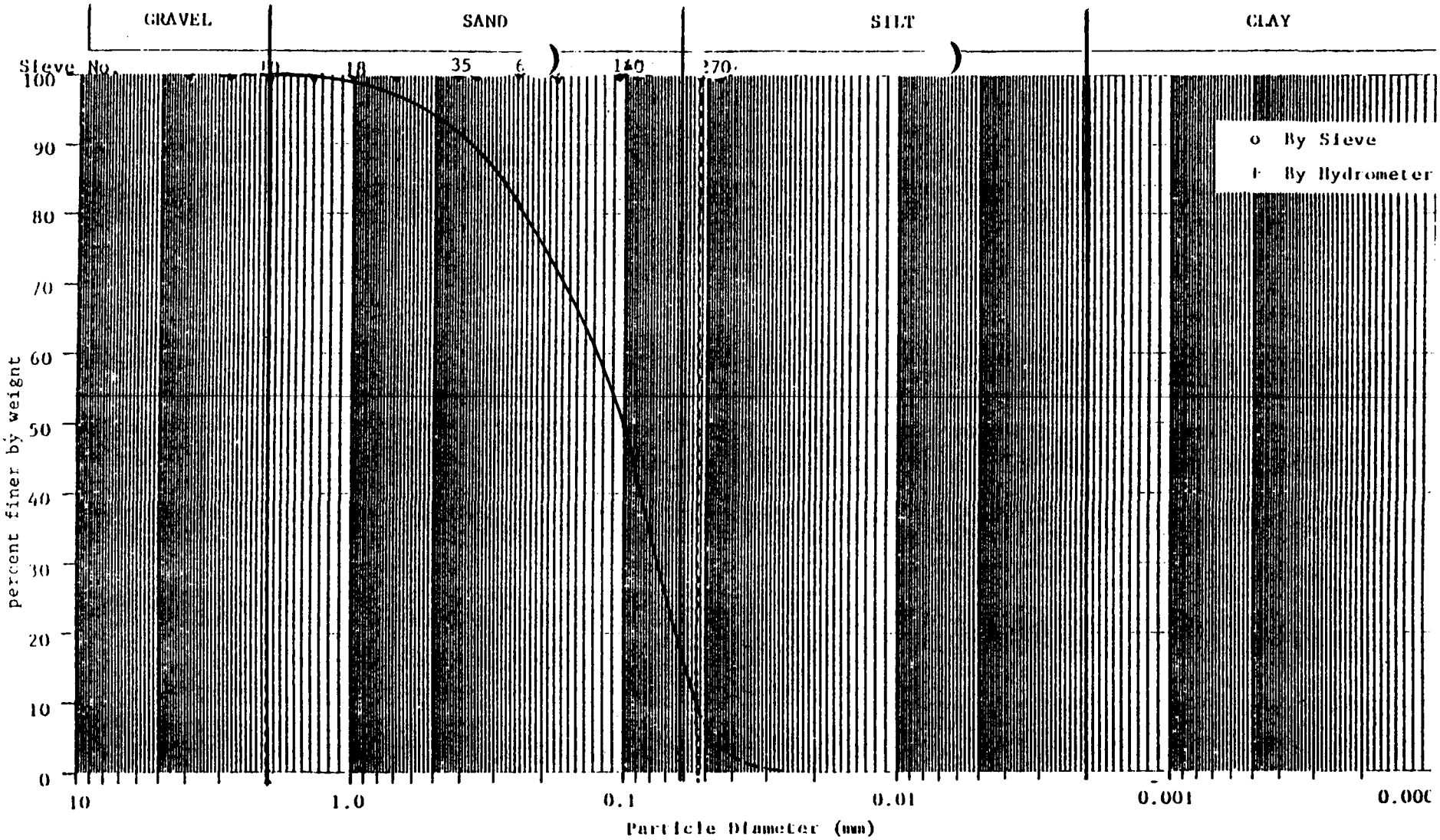
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.74	5.0	NA	
18	1.00	98.13	20.0	Less than	15 % of
35	.417	92.98	60.0	sample finer than	
60	.250	82.38	240.	.053 mm.	
140	.105	49.52	360.		
270	.053	10.17			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel .26 % Sand 82.74 % Silt 17.0 % Clay 0 Name: Sand w/some silt

✓-784

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24226

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) B-3, S-8, 25.0-26.5		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

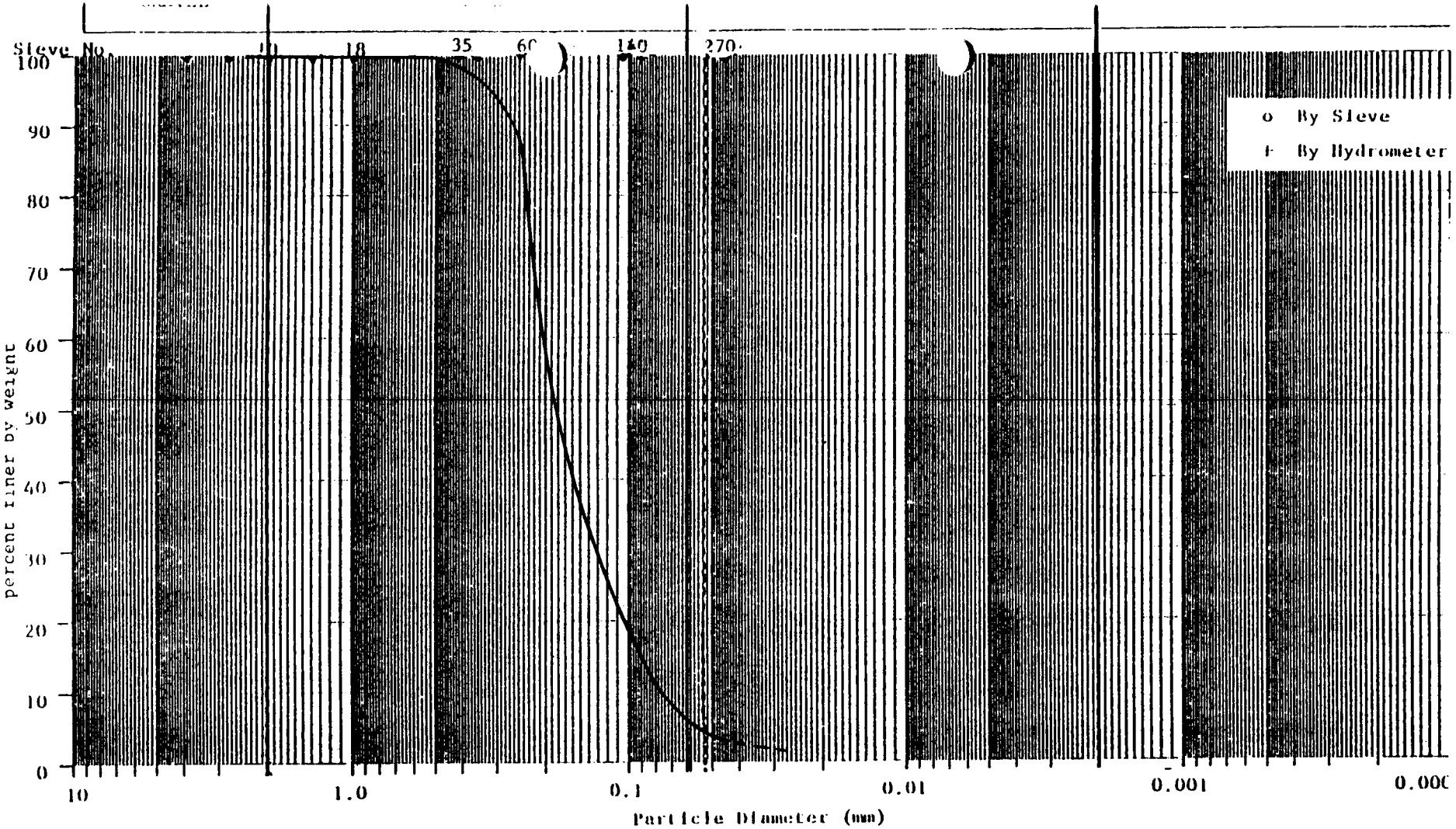
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.87	5.0	NA	
18	1.00	99.64	20.0	Less than	15%
35	.417	97.66	60.0	of sample	finer than
60	.250	83.09	240.	.053 mm.	
140	.105	18.70	360.		
270	.053	4.51			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel .13 % Sand 95.36 % Silt & Clay 4.51 Name: Sand

✓-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24229

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) B-3, S-10, 30.0-31.5		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

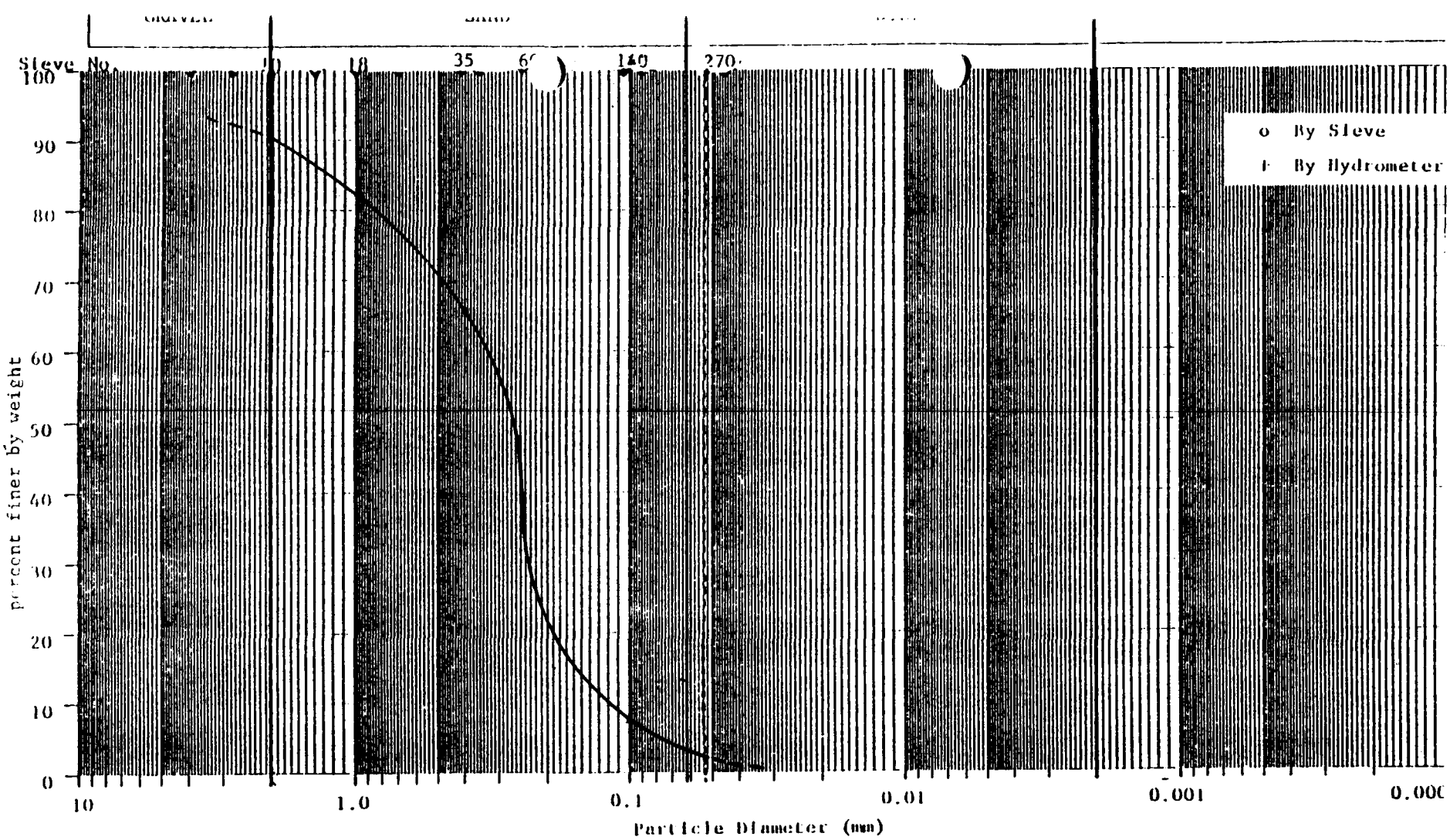
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	90.83	5.0	NA	
18	1.00	83.98	20.0	Less than 15% of	
35	.417	65.82	60.0	sample is finer	
60	.250	39.28	240.	than .053 mm.	
140	.105	7.52	360.		
270	.053	3.01			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 9.17 % Sand 87.82 % Silt & Clay 3.01%

Name: Sand w/some gravel

✓-78(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24228

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) B-3, S-11, 35.0-36.5		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

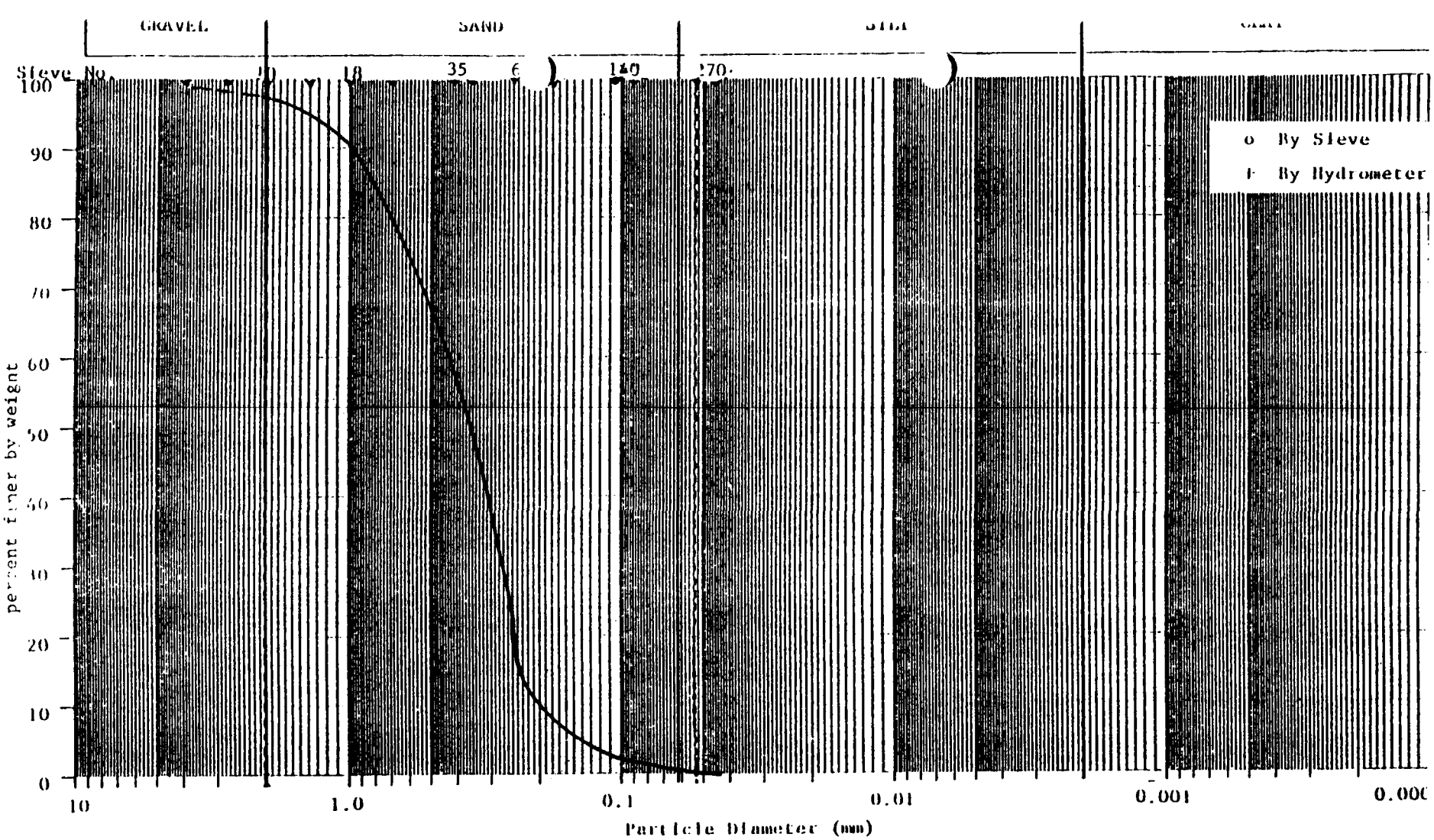
permeablilty:

4.1×10^{-3} cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	97.39	5.0	NA	
18	1.00	90.46	20.0	Less than	15% of
35	.417	56.37	60.0	sample finer than	
60	.250	22.52	240.	.053 mm.	
140	.105	2.92	360.		
270	.053	1.24			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS

Tested By _____

% Gravel 2.61 % Sand 96.15 % Silt & Clay 1.24 Name: Sand

V-78(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24209

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) B-4, S-1, 0.0-2.0		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

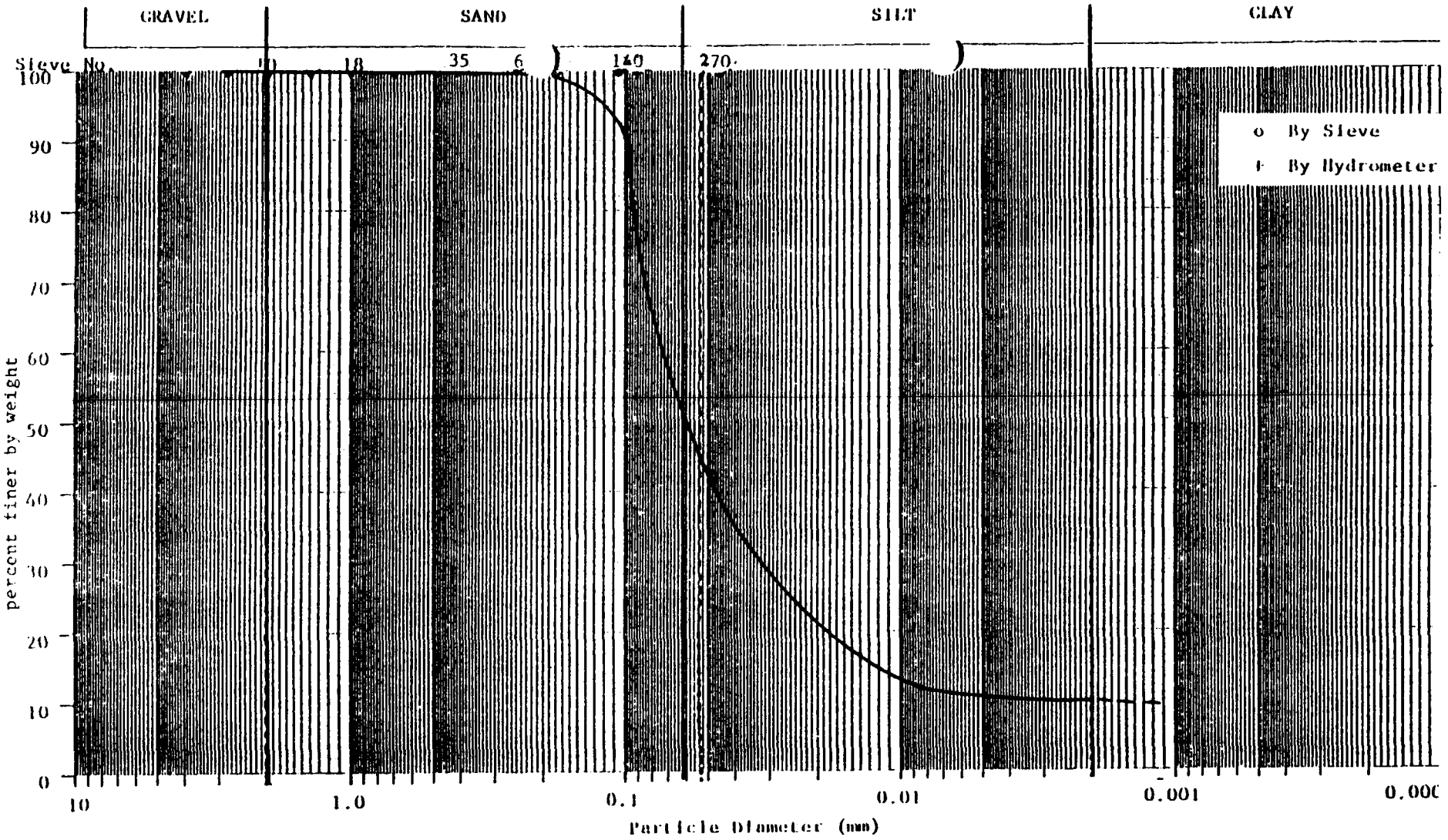
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0 *	0.0140	15.7
18	1.00	100.00	20.0	0.0086	12.3
35	.417	99.96	60.0	0.0049	10.9
60	.250	99.51	240.	0.0023	9.5
140	.105	90.33	360.	0.0020	9.5
270	.053	44.40			
pan					

COMMENTS * 7.75 m



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0 % Sand 58 % Silt 32.5 % Clay 9.5 Name: Silty Sand w/some clay

✓-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24210

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-4, S-2, 2.5-4.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

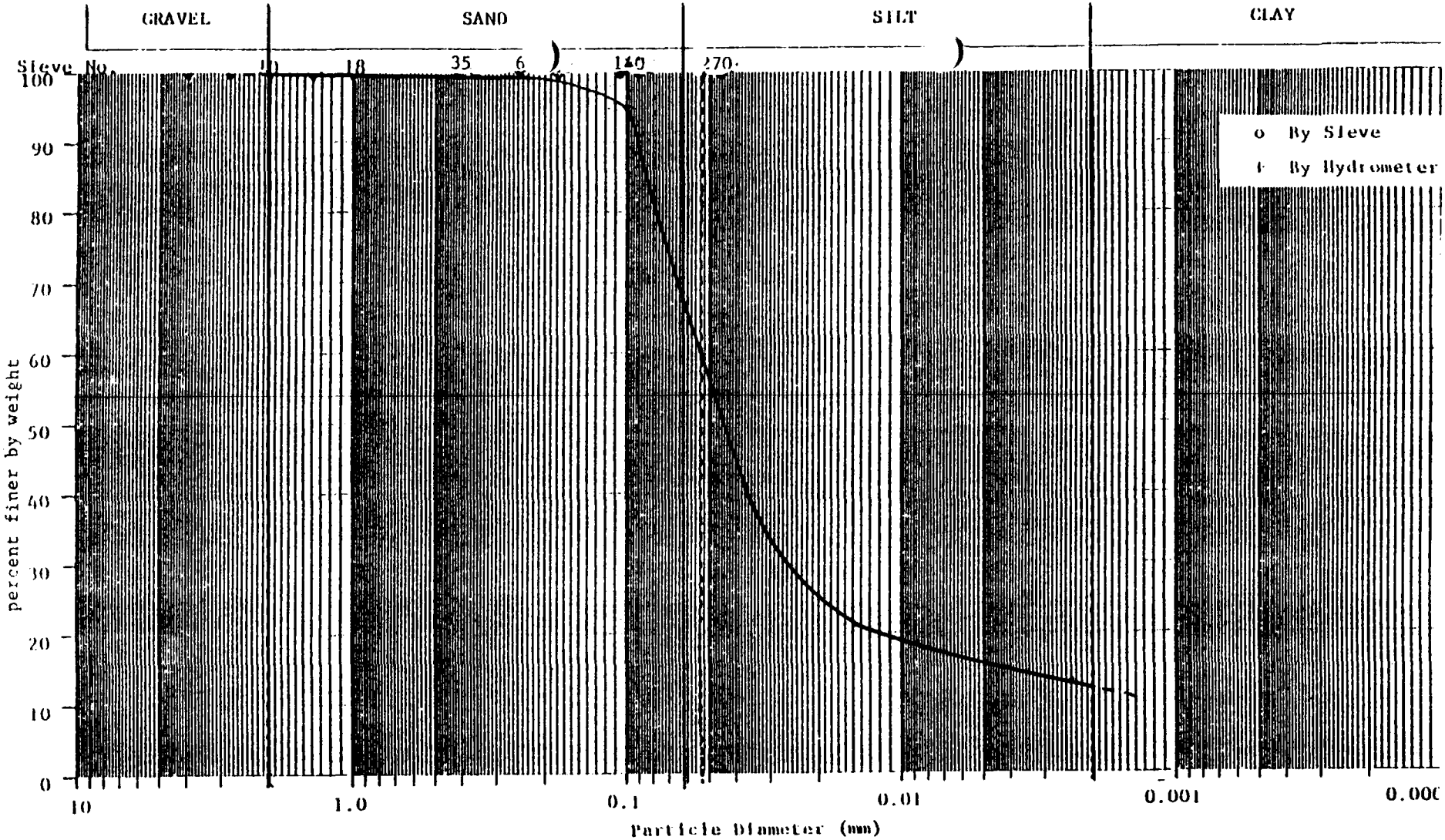
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0148	21.91
18	1.00	99.98	20.0	.0087	18.10
35	.417	99.92	60.0	.0049	15.24
60	.250	99.82	240.	.0023	13.33
140	.105	94.87	360.	.0020	12.39
270	.053	59.90			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0 % Sand 33 % Silt 64.61 % Clay 12.39 Name: Sandy Silt w/some clay

✓-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24211

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) B-4, S-3, 5.0-6.5		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

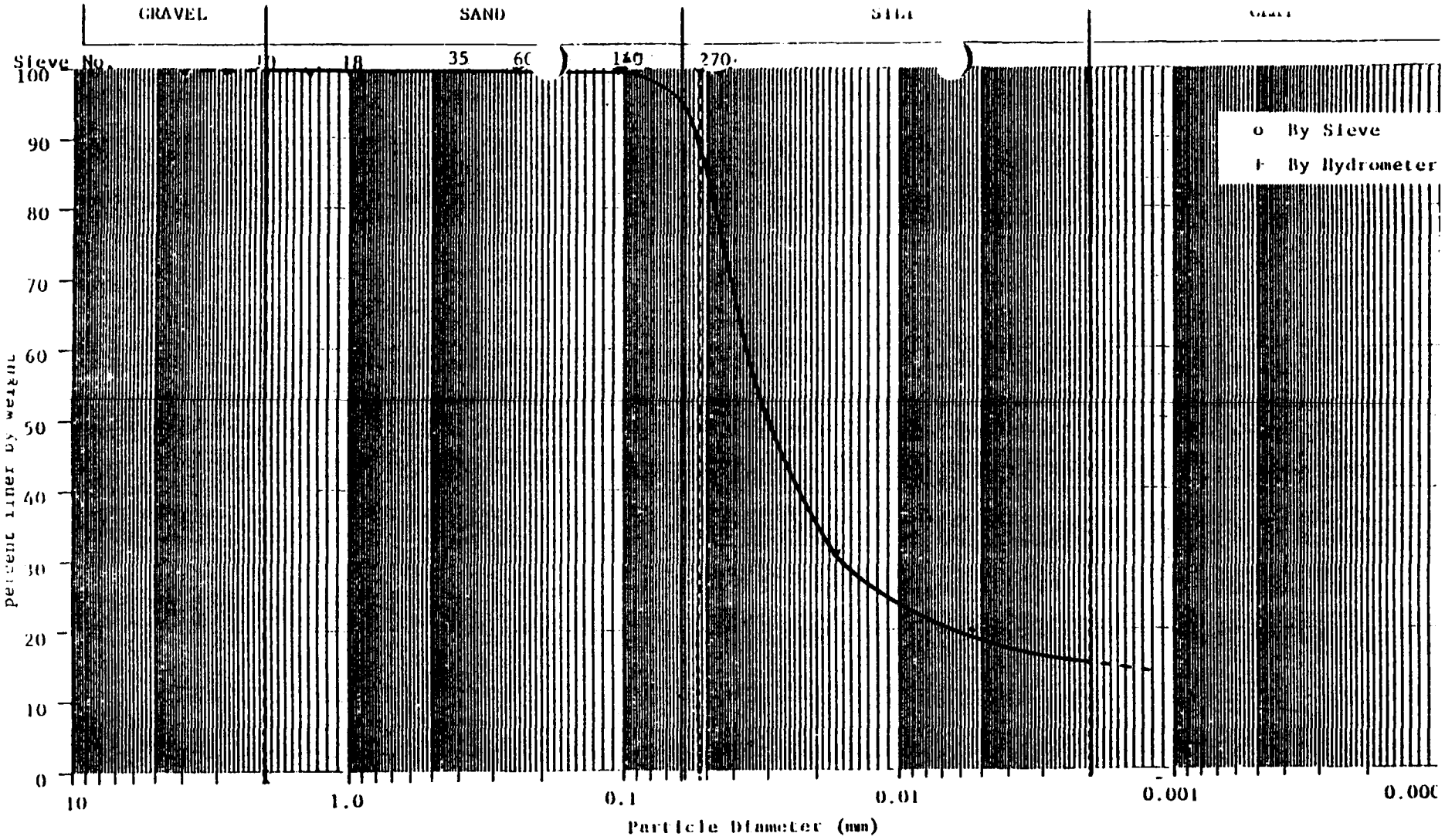
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0171	30.73
18	1.00	99.96	20.0	.0095	22.90
35	.417	99.88	60.0	.0054	19.88
60	.250	99.82	240.	.0025	16.87
140	.105	98.72	360.	.0021	15.67
270	.053	87.98			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel 0 % Sand 6 % Silt 88.33 % Clay 15.67 Name: Clayey Silt w/some sand

V-78(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24214

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-4, S-6, 12.5-14.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

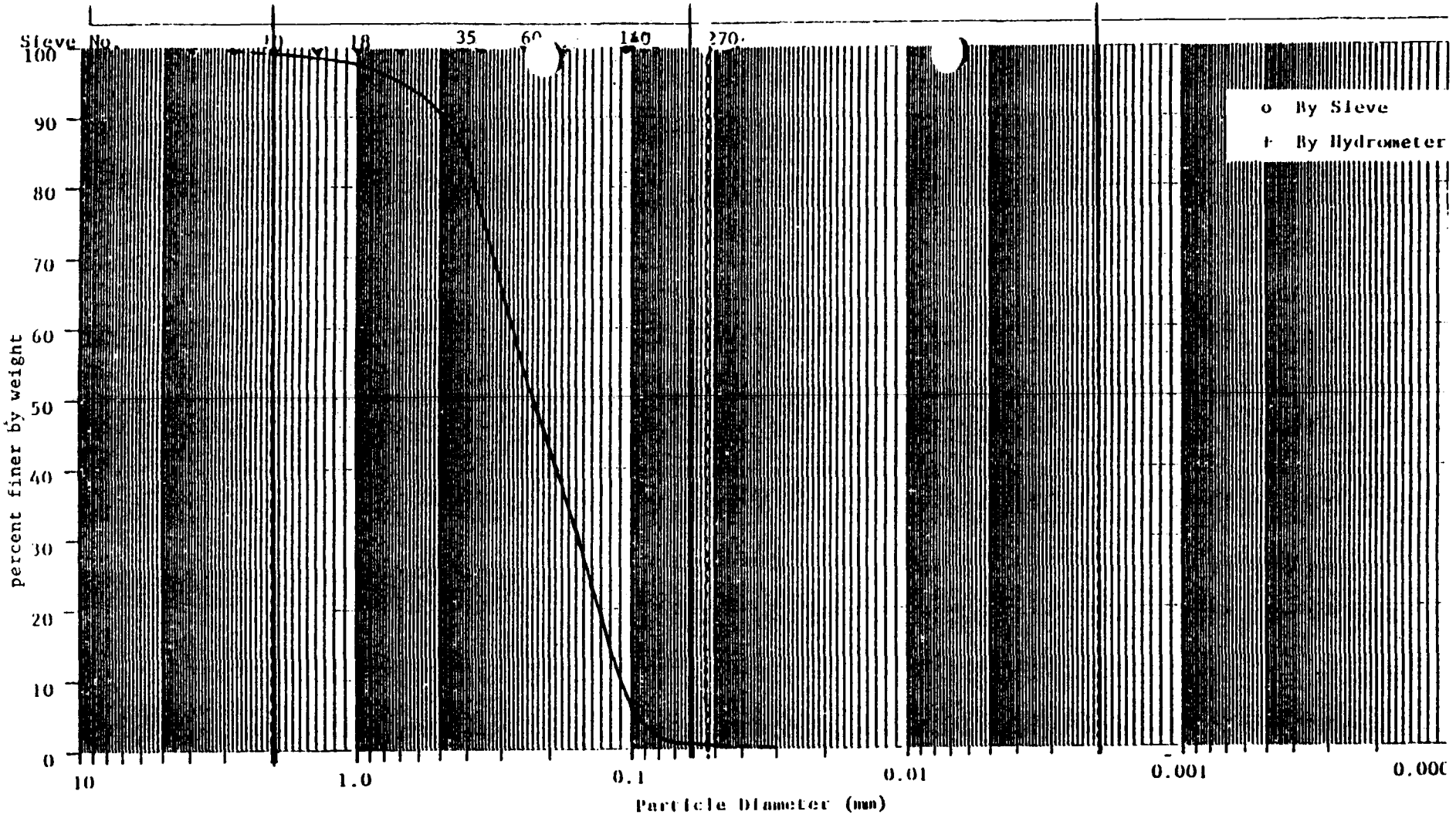
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.46	5.0	Less than	NA
18	1.00	97.84	20.0	15% of	NA
35	.417	83.48	60.0	sample finer	NA
60	.250	48.14	240.	than .053 mm.	NA
140	.105	5.79	360.		NA
270	.053	1.66			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0.54 % Sand 97.8 % Silt& Clay 1.66 Name: Sand

v-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24238

Date Collected 10/20/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

B-8, S-1, 0.0-2.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

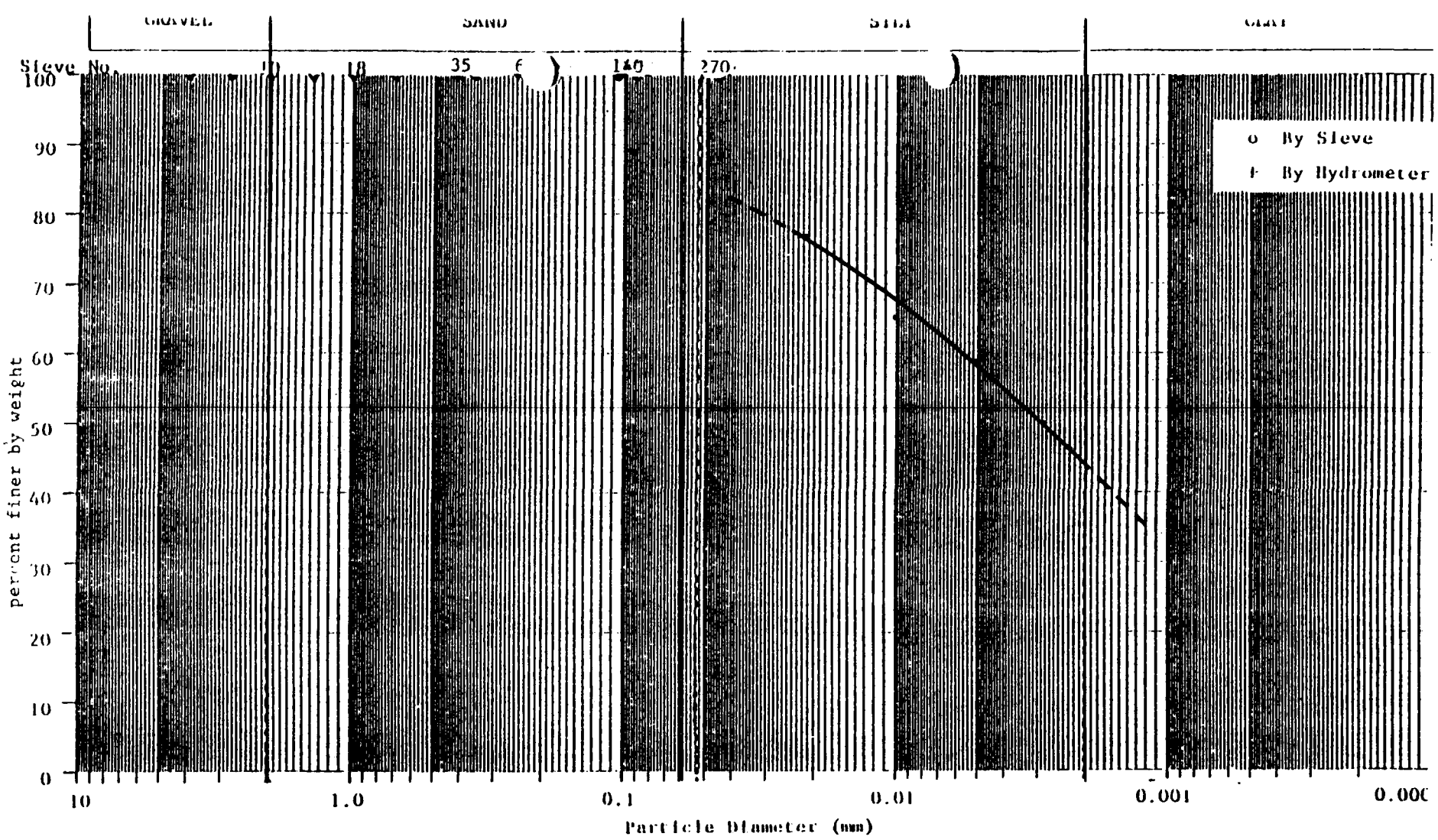
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0227	77.54
18	1.00	Less than 15%	20.0	.0103	64.47
35	.417	of sample	60.0	.0061	58.37
60	.250	greater than	240.	.0029	48.79
140	.105	.053 mm.	360.	.0023	45.30
270	.053				
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel & Sand less than 15% % Silt 39.7 or more % Clay 45.30 Name: Silty Clay

✓-781

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24239

Date Collected 10/20/80 Date Received Nov.14.1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-8, S-2, 2.5-4.0

Physical Observations, Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

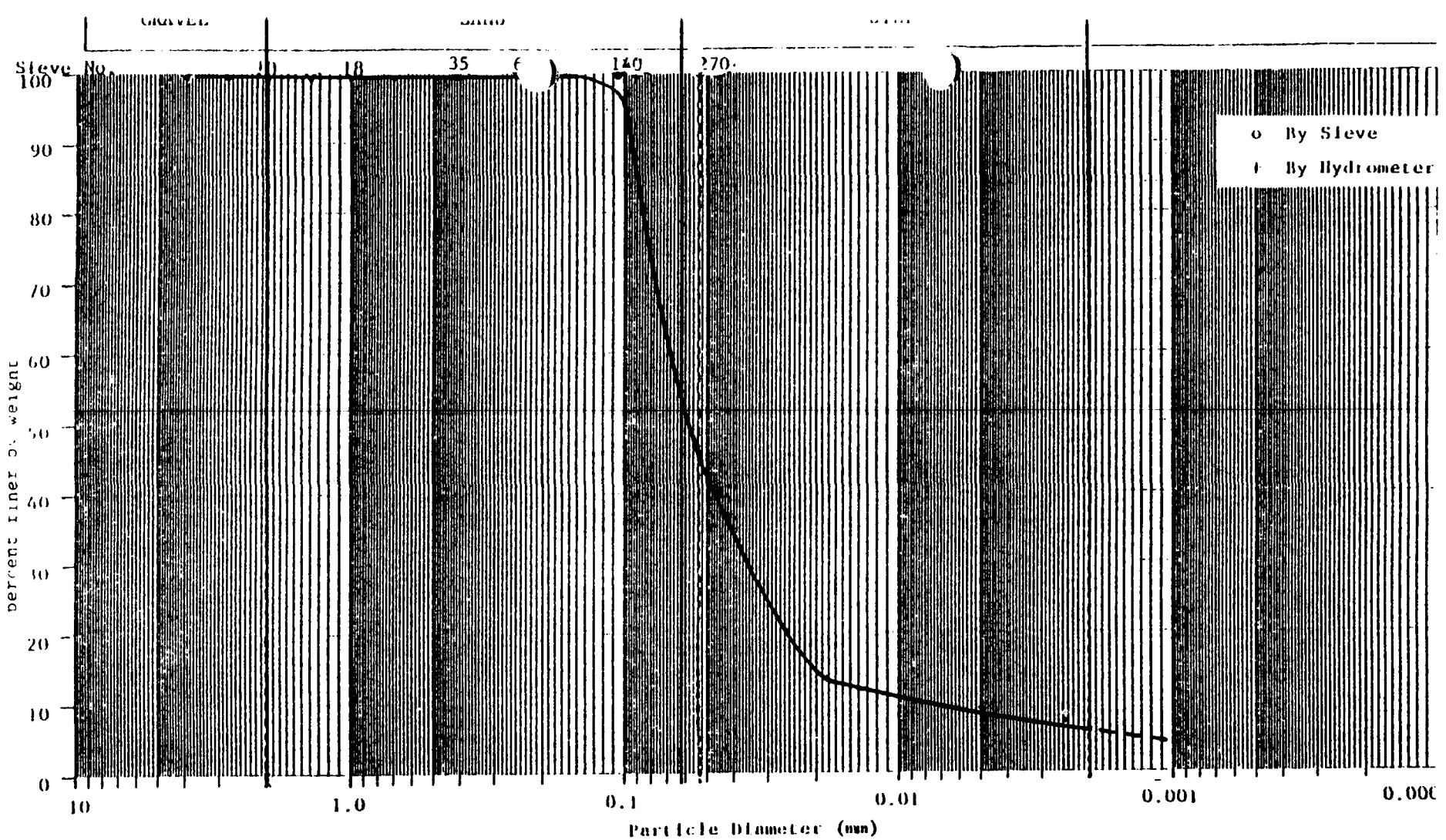
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.87	5.0	.0185	13.07
18	1.00	99.55	20.0	.0088	9.80
35	.417	99.26	60.0	.0050	8.17
60	.250	98.98	240.	.0025	7.35
140	.105	95.70	360.	.0020	6.54
270	.053	46.13			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS

Tested By _____

% Gravel 0.13 % Sand 48 % Silt 45.33 % Clay 6.54 Name: Silty Sand w/some clay

V-78(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24240

Date Collected 10/20/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-8, S-3, 5.0-6.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

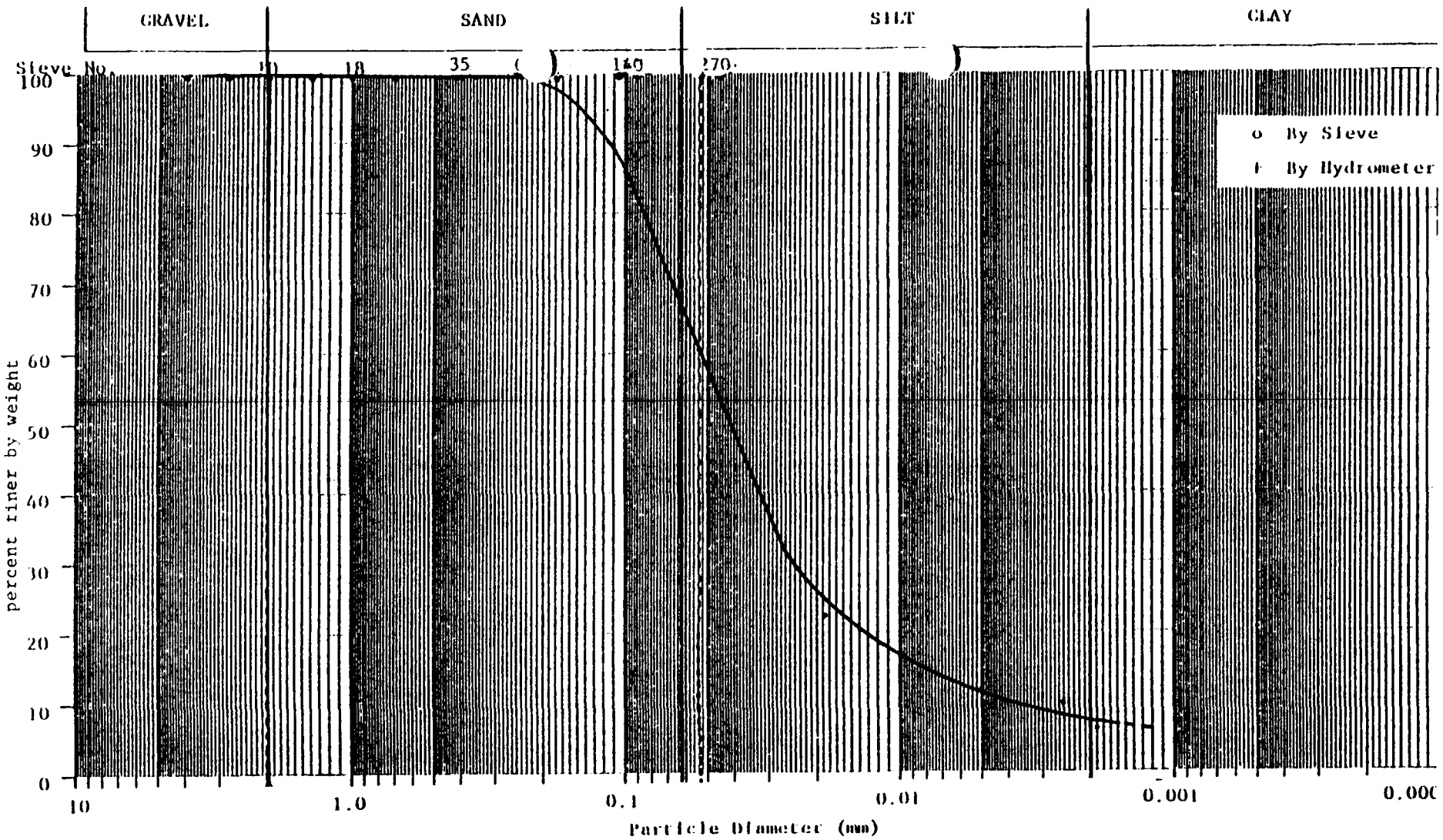
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.93	5.0	.0188	22.49
18	1.00	99.74	20.0	.0085	13.74
35	.417	99.59	60.0	.0050	11.24
60	.250	99.43	240.	.0025	9.99
140	.105	85.55	360.	.0019	6.25
270	.053	61.59			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0.07 % Sand 33 % Silt 60.68 % Clay 6.25 Name: Sandy Silt w/some clay

✓-78(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24242

Date Collected 10/20/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) B-8, S-5, 10.0-11.5		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

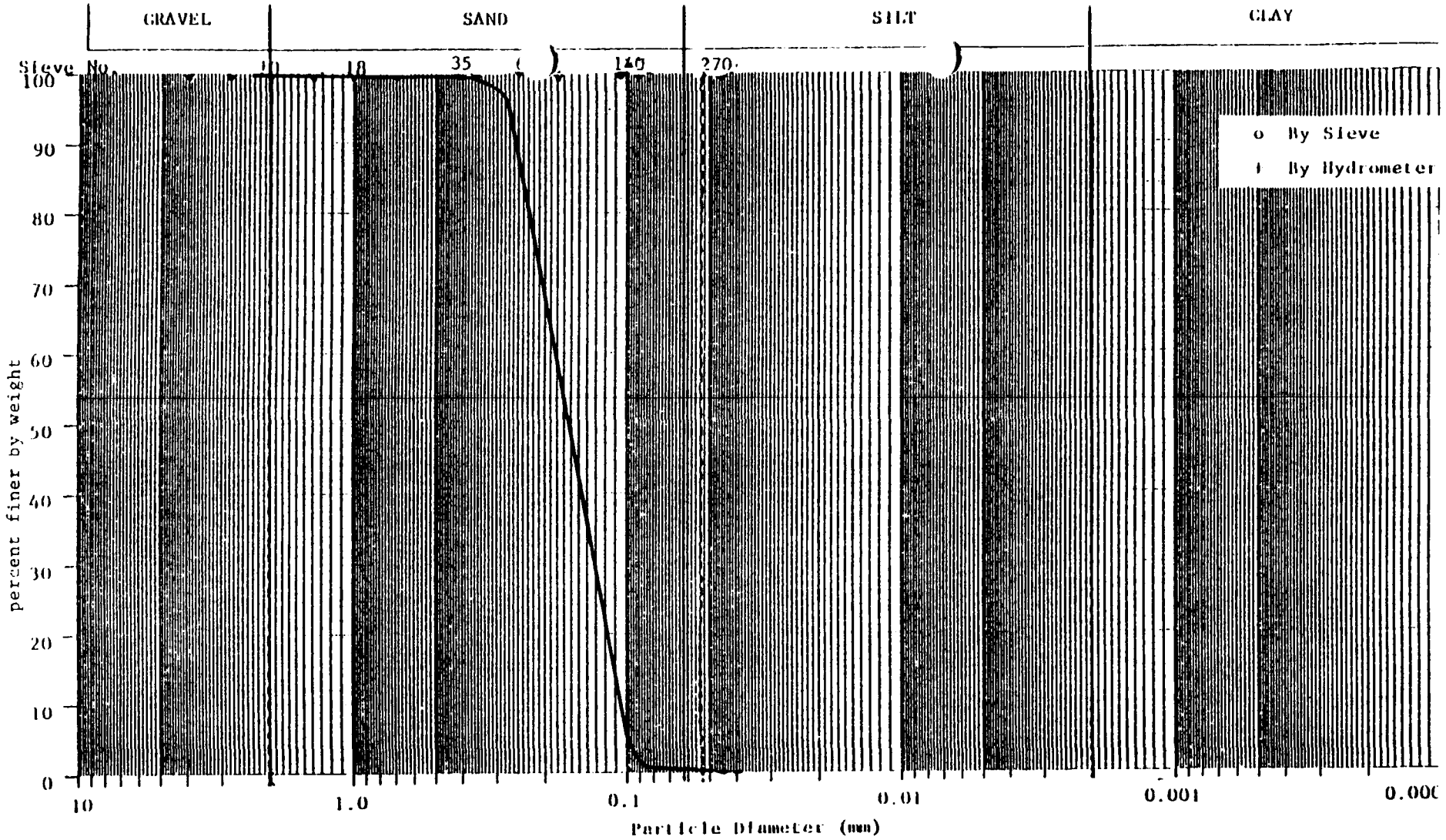
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.98	5.0	NA	
18	1.00	99.93	20.0	Less than	15% of sample
35	.417	99.75	60.0	finer than	.053 mm.
60	.250	79.17	240.		
140	.105	4.97	360.		
270	.053	1.55			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0.02 % Sand 98.43 % Silt& Clay 1.55%

Name: Sand

v-78(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24230

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

P-4, S-1, 0.0-1.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

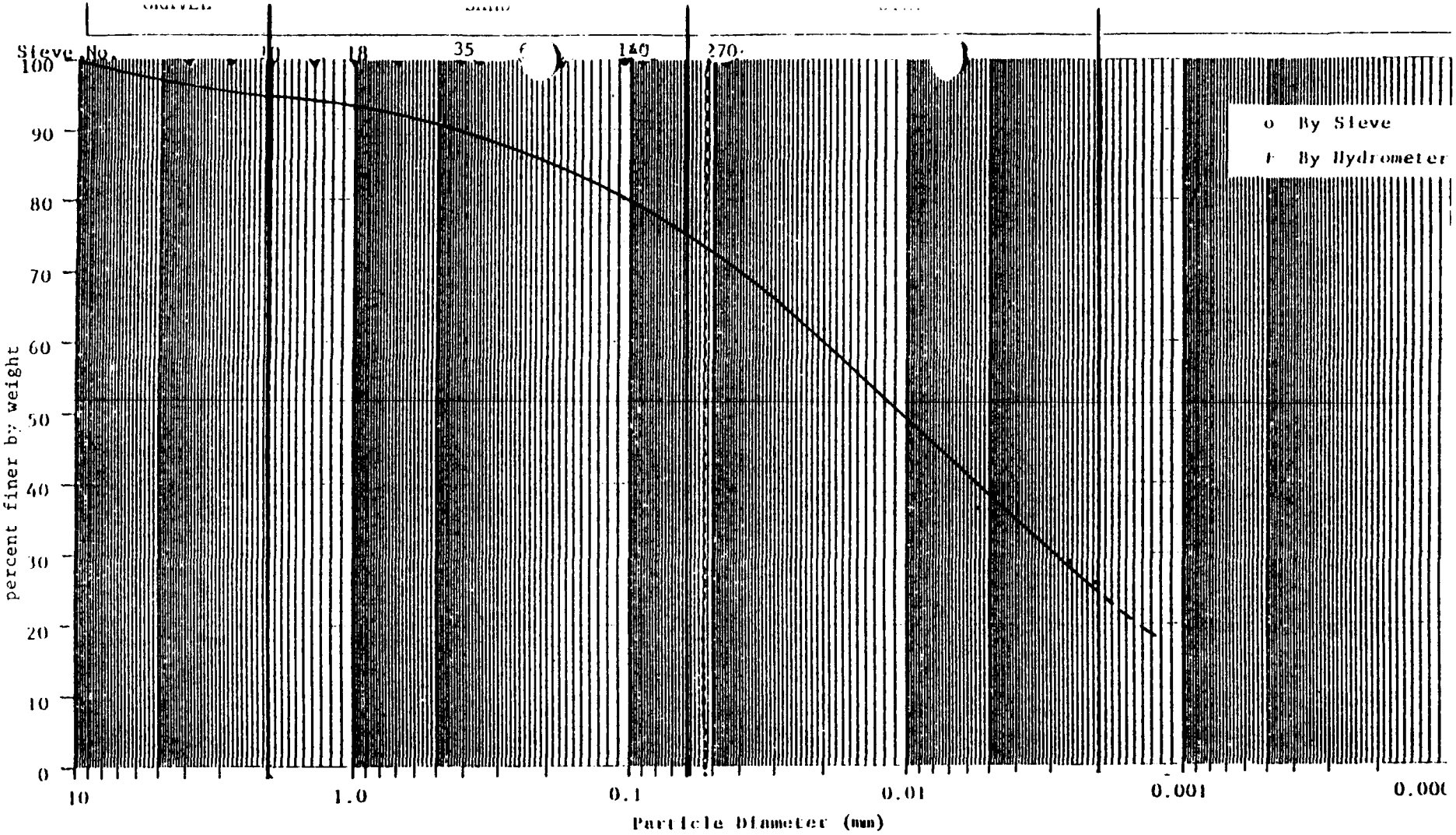
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	95.38	5.0	.0205	62.46
18	1.00	93.32	20.0	.0098	46.60
35	.417	90.27	60.0	.0055	37.68
60	.250	86.07	240.	.0025	28.75
140	.105	80.38	360.	.0021	26.77
270	.053	75.13			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel 4.62 % Sand 20.0 % Silt 48.61 % Clay 26.77 Name: Sandy, Clayey, Silt

✓-78(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24231

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

P-4, S-2, 1.0-2.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

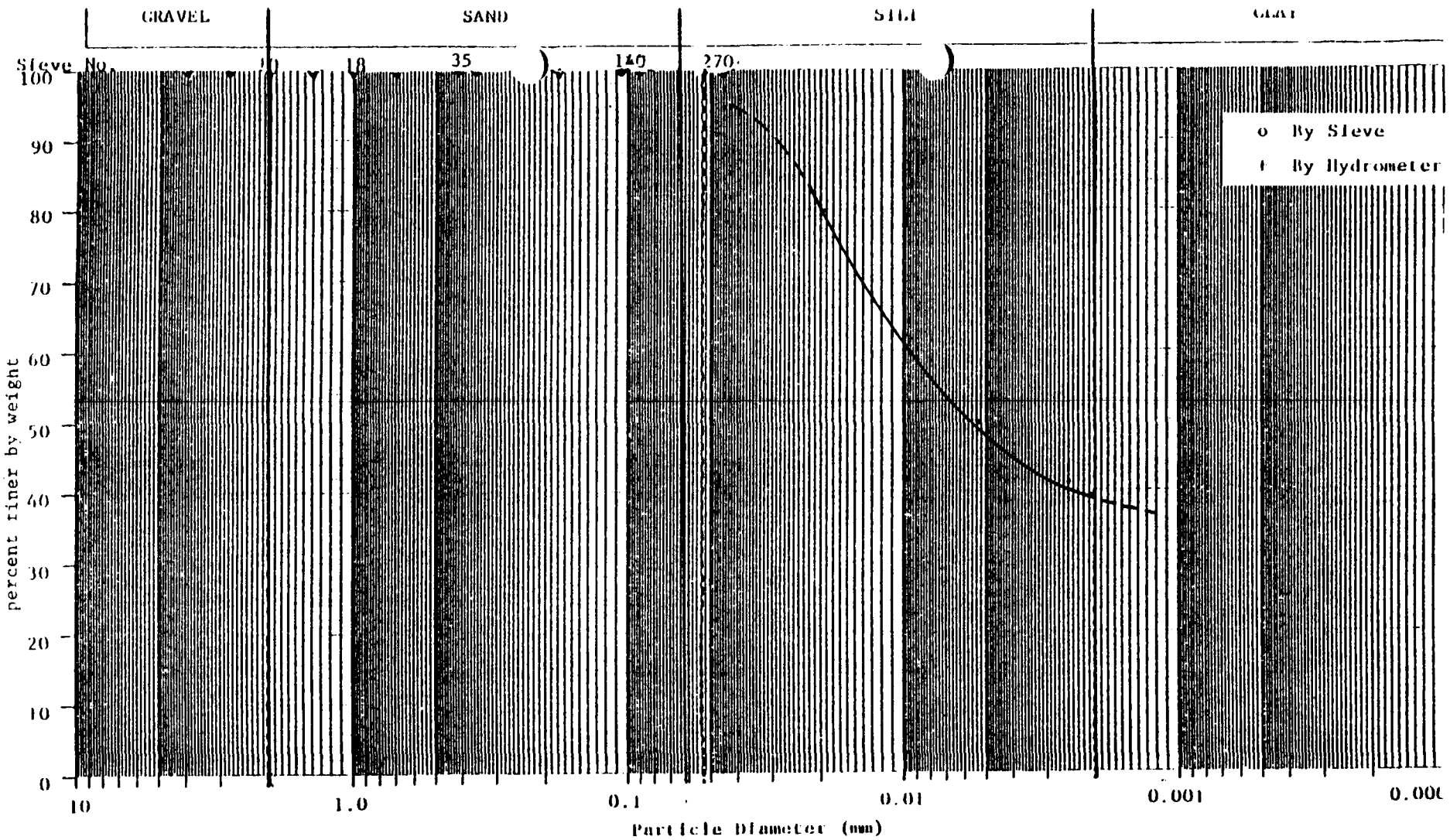
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0199	79.69
18	1.00	Less than	20.0	.0095	59.38
35	.417	15% of sample	60.0	.0053	50.00
60	.250	greater than	240.	.0025	42.19
140	.105	.053 mm.	360.	.0021	39.06
270	.053				
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel & Sand less than 15% % Silt 45.94 or more % Clay 39.06 Name: Clayey Silt

✓-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24232

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) P-4, S-3, 2.0-3.0		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

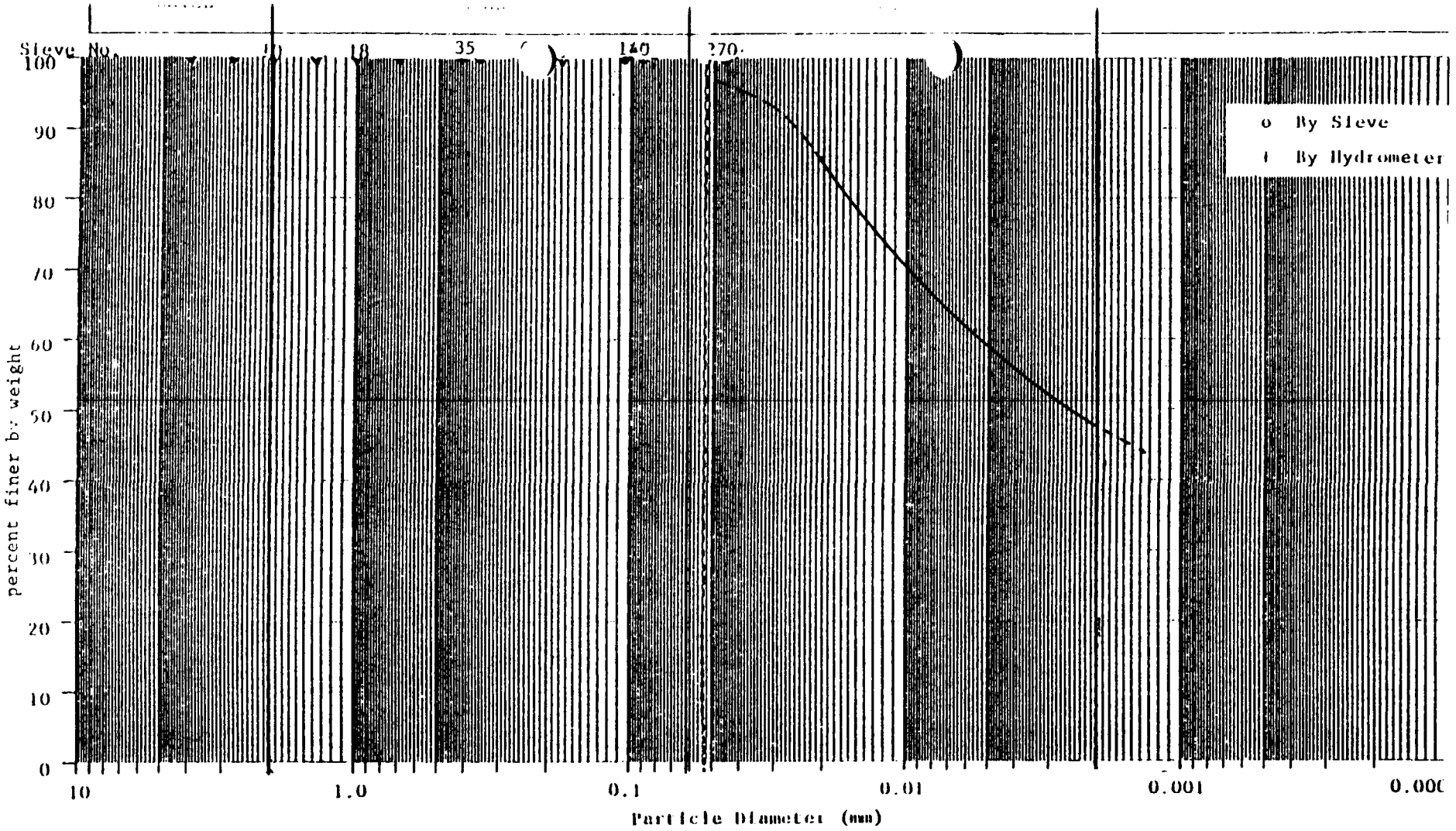
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0209	85.28
18	1.00	Less than	20.0	.0099	70.15
35	.417	15% of	60.0	.0056	61.90
60	.250	sample greater	240.	.0026	50.89
140	.105	than .053 mm.	360.	.0022	48.14
270	.053				
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel & Sand less than 15% % Silt 36.84 or more % Clay 48.14 Name: Silty Clay

v-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24233

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) P-4, S-4, 3.0-4.0		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

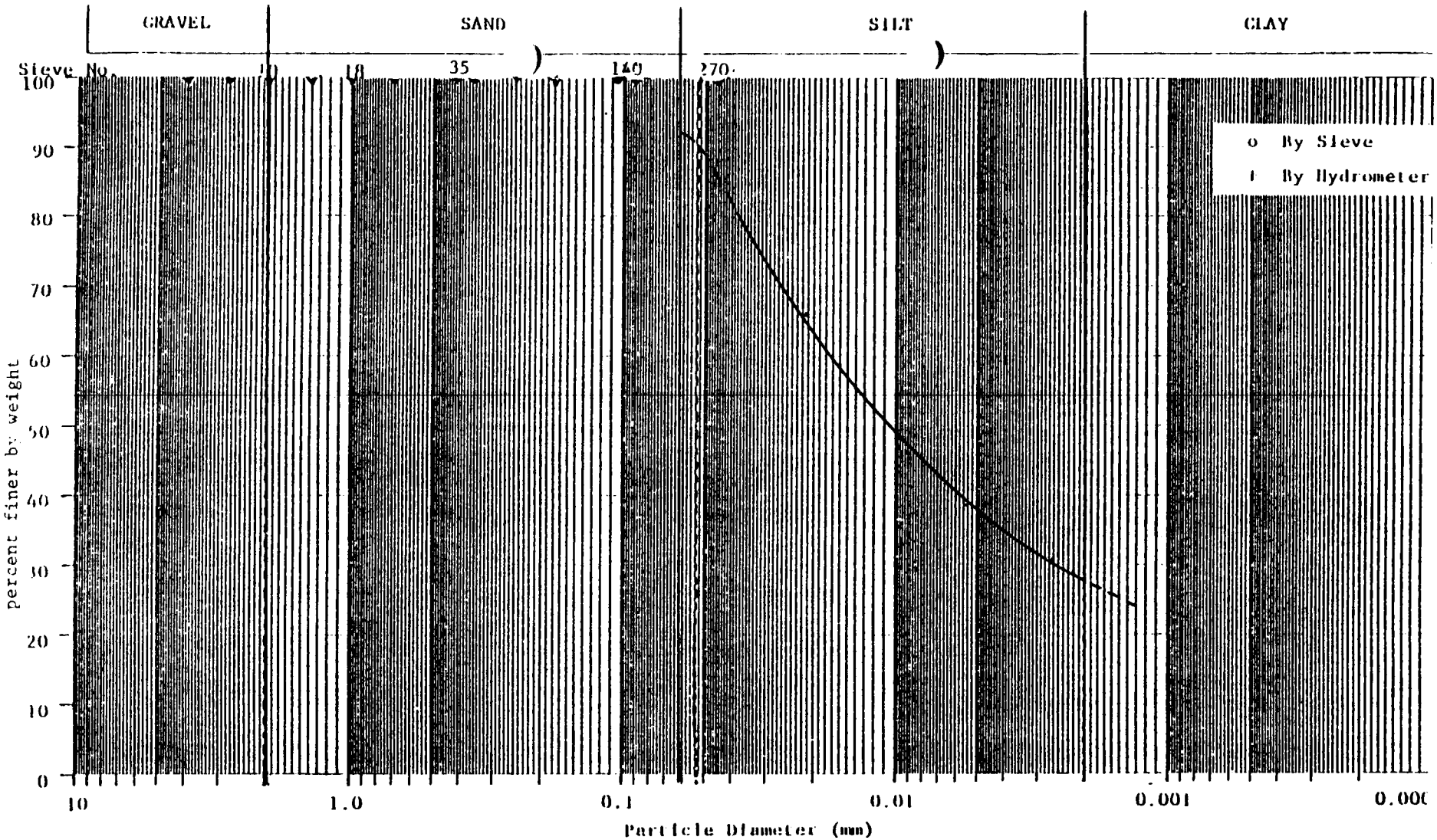
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0212	65.66
18	1.00	Less than	20.0	.0091	46.35
35	.417	15% of	60.0	.0055	38.62
60	.250	sample greater	240.	.0027	30.90
140	.105	than .053 mm.	360.	.0022	28.97
270	.053				
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel & Sand less than 15% % Silt 56.03 or more % Clay 28.97 Name: Clayey Silt

V-781

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24234

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

P-4, S-5, 4.0-5.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

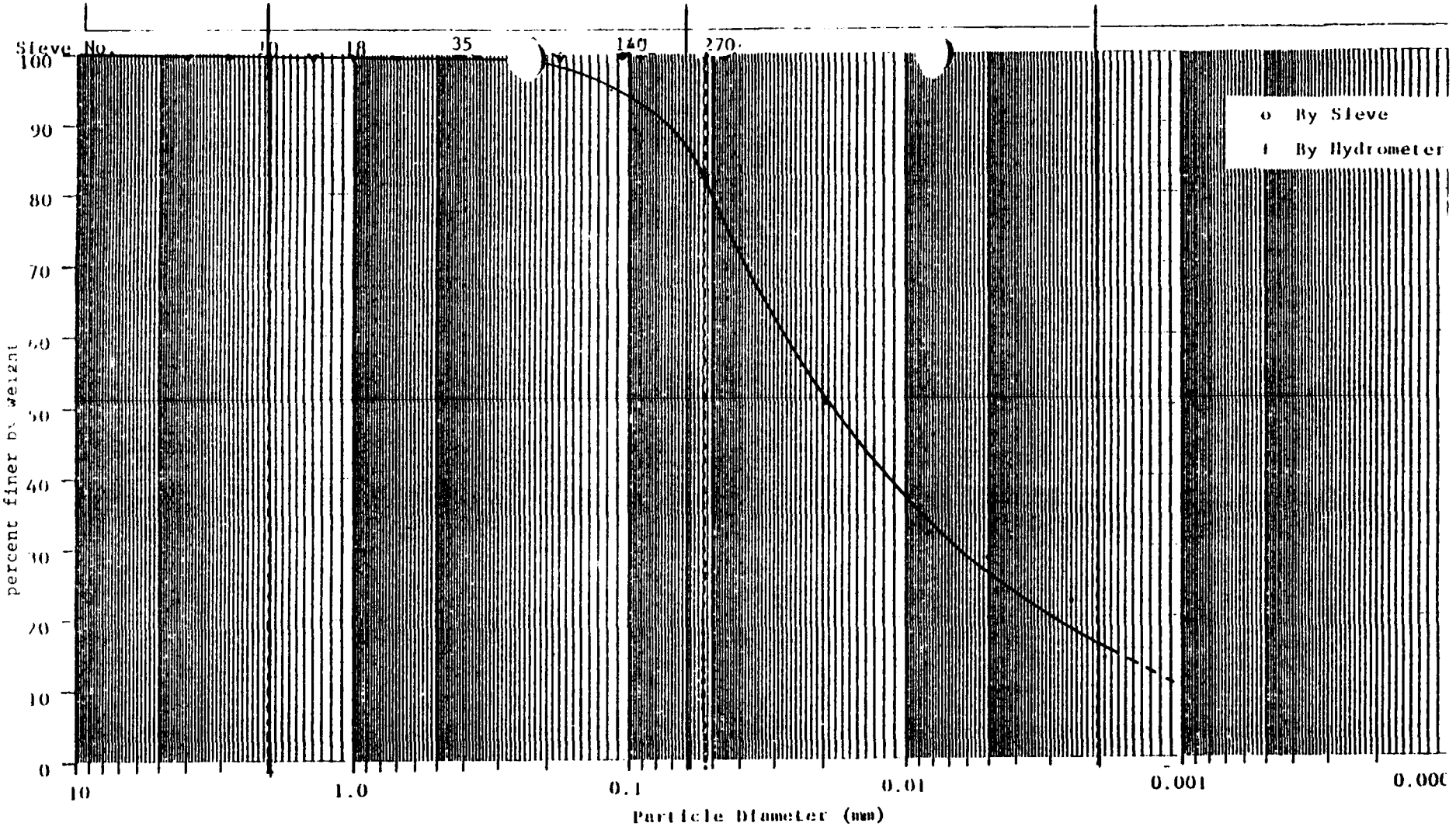
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0187	50.08
18	1.00	99.86	20.0	.0083	32.91
35	.417	99.48	60.0	.0050	28.62
60	.250	98.48	240.	.0025	22.90
140	.105	95.82	360.	.0019	14.31
270	.053	82.05			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Tested By _____

Illinois Environmental Protection Agency---DLS

% Gravel 0 % Sand 13 % Silt 77.69 % Clay 14.31 Name: Sandy, Clayey, Silt

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24235

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
P-4, S-6, 5.0-6.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

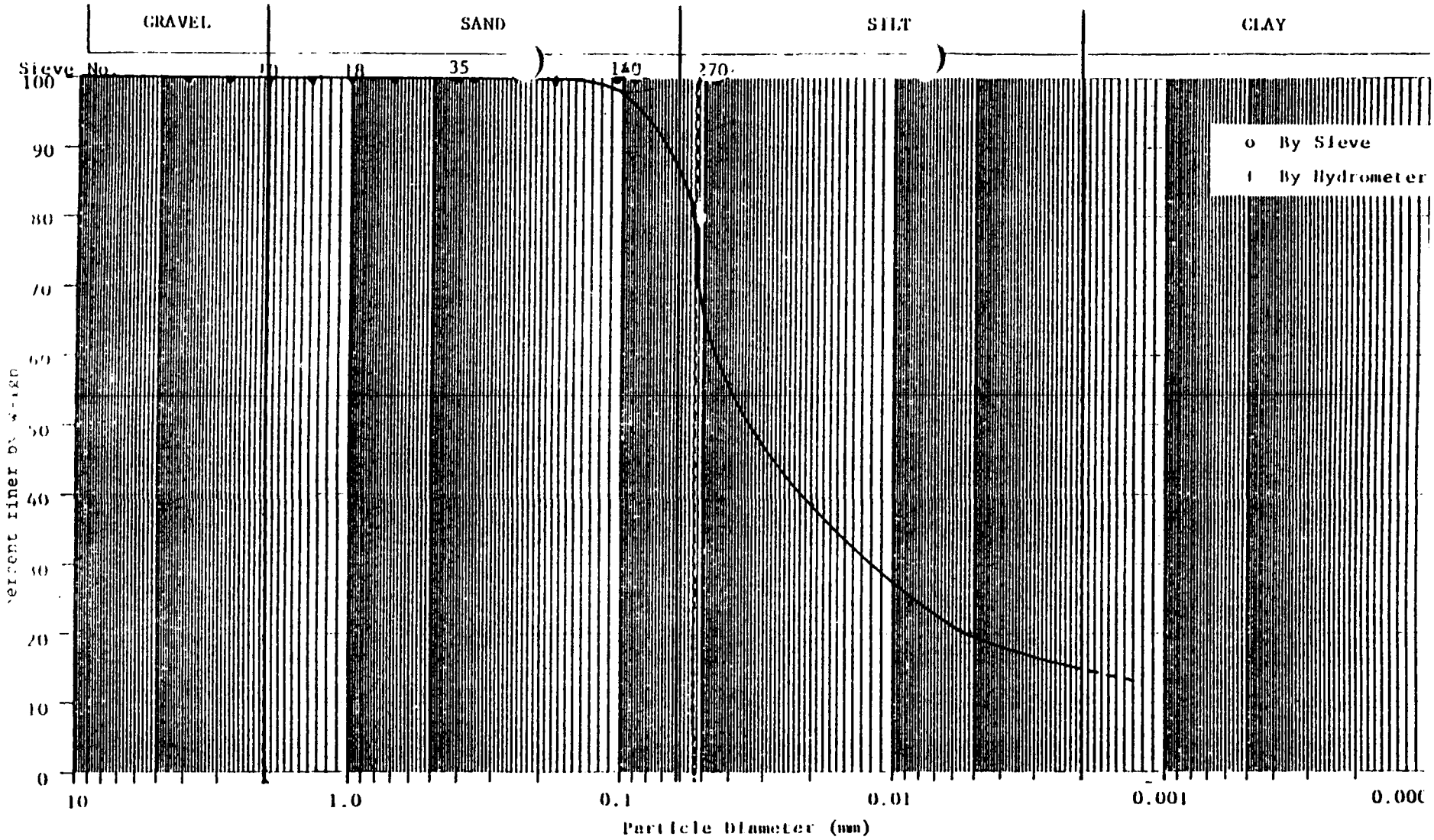
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.98	5.0	.0200	38.55
18	1.00	99.88	20.0	.0086	24.19
35	.417	99.61	60.0	.0052	20.41
60	.250	98.98	240.	.0025	16.63
140	.105	97.15	360.	.0021	15.87
270	.053	80.35			
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel 0.02 % Sand 12 % Silt 72.11 % Clay 15.87 Name: Sandy Clayey, Silt

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ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected _____ Laboratory ID No. B 24236

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code _____

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
P-4, S-7, 6.0-7.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER _____

DATE ANALYSIS COMPLETED _____

DATE ANAYSIS REPORTED _____

TEST RESULTS

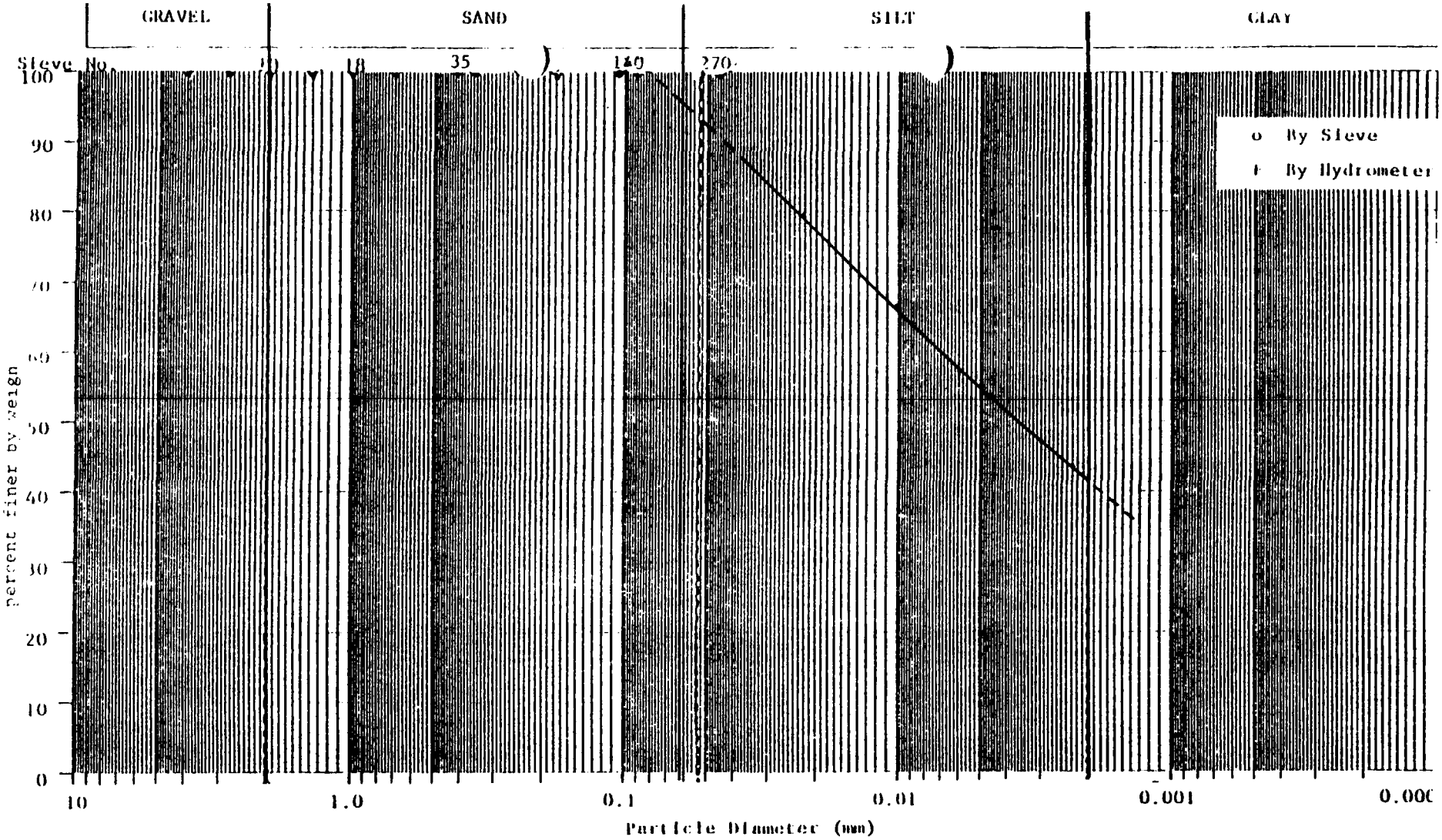
permeablilty:

_____ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0222	79.14
18	1.00	Less than	20.0	.0101	67.55
35	.417	15% of	60.0	.0060	57.90
60	.250	sample greater	240.	.0029	47.29
140	.105	than .053 mm.	360.	.0023	44.39
270	.053				
pan					

COMMENTS _____



Sample No. (Field) _____ Sample No. (Lab.) _____ Date _____

Illinois Environmental Protection Agency---DLS Tested By _____

% Gravel & Sand less than 15% % Silt 40.0 or more % Clay 42.0 Name: Silty Clay

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Appendix 3 - Geophysical Equipment

Equipment Specifications

Two forms of seismic equipment were tried in the study area. A Geospace GT2B 12 channel portable refraction unit, utilizing plastic explosives, and a Bison 1570A signal enhancement seismic unit were used in an attempt to locate the position, size, and depth of the former sand pits in the area. Neither unit was successful as there was too much interference in the area caused by industry and traffic.

Information pertaining to the metal detector used appears in Figure A-2.

FISHER'S M-Scope Model TW-5

PIPE and CABLE LOCATOR

FEATURES

- Auto-Sensitivity Meter
- Discriminator circuit eliminates outside interference, such as 60-Hz signals
- Three operating modes: Inductive Location, Inductive Tracing, and Conductive Tracing
- Wide scope of applications: the TW-5 locates, traces, pinpoints, and determines depth
- Easy and accurate depth measurement thanks to 45° bull's-eye level built into the control housing; even greater accuracy using the tracer probe
- All solid-state circuitry
- Field-proven reliability
- Moisture-resistant
- Built-in Loudspeaker
- 5-Year Limited Gold Seal Warranty

fisher M-SCOPE

FRL, INC. a subsidiary of Cohu, Inc.

Figure A-2. Metal detector specifications